Hi-Tech Solutions

C50 & C6
Installation Manual

Document Information

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Table of Contents

Chapter 1: Introduction 4
List of Acronyms 4
Safety Symbols 5
Other Symbols 5
LED Safety Compliance 5
Laser Safety compliance 6
Referenced Documents 6
Document History 6
Required tools 7
Components of the C50 or C6 7
Chapter 2: Cables Connections 8
Ethernet connector components 9
Flexible protective conduit cable 12
Power Supply (4 Pins – connector wiring) 12
I/O connector (7 pins- connector wiring) 13
Connecting (optional) power supply 15
Chapter 3: Camera/Bracket Assembly 16
Bracket and Camera Installation on a Wall or Pole 19
Chapter 4: Camera/Mobile PC Connection 22
Chapter 5: Software Application Settings 24
Lane level 25
Lane Settings 25
Camera Level-Setting Dual or Single camera 27
Capture Sets 30
General Settings 31
Save Image Settings 33
Communication Settings 34
Diagnostics Settings 35
System Alert Settings 38
Chapter 6: Single Camera/Dual Cameras – on site Calibration and Fine-tuning 40
General Information 40

Cameras calibration 41
Calibrating first camera- B/W Camera 42
Calibrating second camera- Color Camera 43
Live Video Mode 45
Recognition Camera Setting (Shutter and Gain) 46
Chapter 7: VMD Software Trigger - on site calibration & fine-tuning 47
Defining the Area of Interest 47
Chapter 8: Hardware Trigger – Laser Trigger 49
Laser Trigger configuration 49
Laser installation 50
Laser Setup 50
Laser configuration 51
Chapter 9: Hardware Trigger - Ground Loops Trigger configuration 55
Preparations 55
Installation Location Considerations 55
Chapter 10: QC- calibration check list form 60
Chapter 11: Support and More Information 64
Contact Information 64
Appendix A: IP configuration 65
LAN connection: 65
Configure lane ID: 65
Explanation: 65
Appendix B: Configuring the laser trigger to MANUAL 66
Appendix C: Ground Loop, Specifications & user guides 68
SMA Datasheet 68
Matrix Ground Loop User Guide 69

Chapter 1: Introduction

This installation guide will allow you to quickly install the C50 or C6 recognition system with minimal effort. After installation, the unit will now be fully functional for its various intended uses such as toll roads, surveillance, average speed and car flow, etc. Prior to installing the unit, pay special attention to the list of acronyms, unit conversion, safety symbols, LED safety compliance, and tools required for installation.

List of Acronyms

Acronym	Meaning
A/I	Auto Iris
B&W	Black and white
CPU	Central processing unit
DLL	Dynamic Link Library
DPU	Digital Processing Unit
EKF	Industrial Computer
FOV	Field Of View
GUI	Graphic User Interface
HW	Hardware
ID	Identification
I/O	Input/output
IR	Infra-Red
LED	Light Emitting Diodes
LPR	License Plate Recognition
OS	Operating system
PC	Personal computer
P/S	Power Supply
SBC	Single Board Computer
SDK	Software Development Kit
SW	Software
TCP/IP	Transmission Control Protocol/Internet protocol
WCF	Windows Communication Foundation

Safety Symbols

Observe all safety statements to help prevent loss of service, equipment damage, personal injury, and security problems. This guide uses the following safety symbols:

Important: An Important statement calls attention to information important to the reader.

WARNING: A warning statement calls attention to a situation that can result in harm to hardware or equipment.

HAZARD: A hazard statement calls attention to a situation that could cause personal injury if the hazard is not avoided by following the instructions provided.

Other Symbols

A Note statement calls your attention to additional information.

LED Safety Compliance

The internal illumination unit complies with International Standard IEC 60825–1, for Class 1 LED (light emitting diodes) products containing Class 1 LED's. This Class 1 LED product poses no hazard to the user or to any other person present near the illumination unit. Use of the illumination unit is totally safe and needs no specific precautions.

HAZARD: Do not look directly into the camera for more than a few seconds.

Laser Safety compliance

In Operational Mode: The FLM-10-T is classified as a Class 1 eye safe laser product in compliance with the European Eye Safety Regulation:

CENELEC EN60825-1 (2001)

HAZARD: Do not look directly into the Laser for more than a few seconds.

Referenced Documents

For more information on SeeWay and related systems, see the following guide.

SeeWay Utilities – Description of utilities (iWD, iCalJAI, iCleaner)

Document History

Ver #	Version Date	Author	Comment	Sections Affected
1.0	01/01/2011	Doron A	First release	All
1.1	04/07/2011	Yossi Rosoff	Updated entire manual	All

Required tools

- Allen wrench (5.30mm)
- Allen wrench (8mm)
- Phillips head screwdriver (4.95mm)

Components of the C50 or C6

- C50 or C6 -IR high speed system.
- Power supply is 24 VDC (optional. Available for purchase at Hi-Tech Solutions).
- Connector 6+PE B-0218-00-07 binder.
- Connector 3+PE B-0210-00-04 binder.
- Bracket 3 axis anodized gold set.
- Ethernet connector px 0834/B.
- Flexible protective conduit cable (available for purchase outside of Hi-Tech Solutions).
- Power supply cable (optional, available for purchase at Hi-Tech Solutions).
- Ethernet cable (available for purchase outside of Hi-Tech Solutions).

NOTE: Hi-Tech Solutions recommends an Ethernet cable of 5E or 6 for a distance up to 100 meters.

Chapter 2: Cables Connections

This chapter will show you the step-by-step procedure on how to assemble the camera head cables and connectors.

The general gantry wiring design is shown in the following figure:

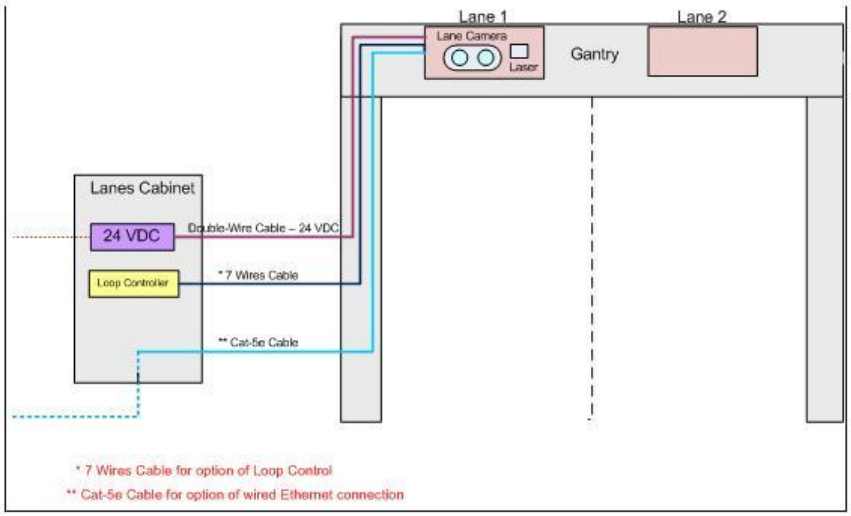


Figure 1: General gantry wiring design

Cable types:

- For the power cable use cable that contain 2 wires of 14 AWG,
- For the 7 Wires cable use cable that contain 7 wires of 22 AWG.
- For the Ethernet Cable use Category 5e cable.

The ends of the cables are connected to the C50 or C6 camera head by the following connectors:

- Ethernet connector PX0834/A and PX0834/B Ethernet Buccaneer.
- Power Supply "Binder Connector" number B-0210-00-04.
- I/O connector "Binder Connector" number B-0210-00-04.

Ethernet connector components

1. Locking ring
2. Locking ring tool
3. Carrier molding
4. RJ45 plug
5. Load bar
6. Connector body
7. Gland
8. Gland cage
9. Gland nut
10. Cable

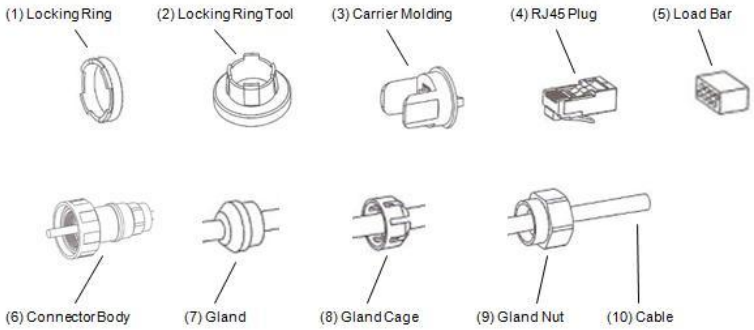


Figure 2: Ethernet connector components

To assemble Ethernet connector:

1. Thread the **gland nut**, **gland cage**, and **connector body** on to the cable.

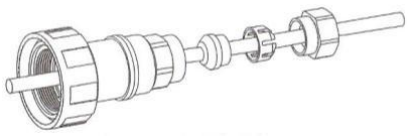


Figure 3: Gland nut, gland cage and connector body

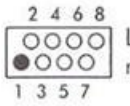
2. Remove the **cable jacket** carefully taking care not to damage the braid and foil. Fold back the **braid** and **foil** over the **cable jacket**.

Figure 4: Cable jacket

3. Un-twist the **conductors** and feed through the appropriate hole in the load bar, according to the loading standard required. Push the **loading bar** fully home on to cable. Trim **conductors** to extend 8.64 mm (0.34") out of the front of the load bar.

Wiring Configuration

568-A	Position	568-B
White/Green	1	White/Orange
Green	2	Orange
White/Orange	3	White/Green
Blue	4	Blue
White/Blue	5	White/Blue
Orange	6	Green
White/Brown	7	White/Brown
Brown	8	Brown



Loading bar viewed from rear, wire entry side.

Figure 5: Load bars and cable jacket conductors

4. Push the **load bar** and **cable** fully home into the **RJ45**, ensuring the braid and **foil** are in contact with the **metal shell**. Crimp the **RJ45** with an appropriate **crimp tool** and die set. Trim back **braid** and **foil** flush with the rear of the **RJ45** body.

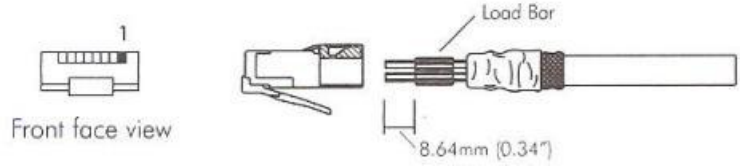


Figure 6: RJ45 and load bar cable

5. Crop the **latching clip** on the **RJ45** making sure that it's completely removed.

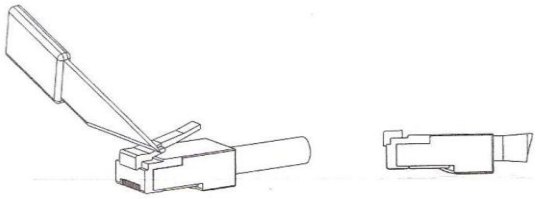


Figure 7: RJ45 plug

6. Push the **RJ45** into the **carrier molding** until it latches.

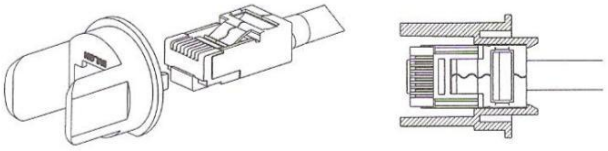


Figure 8: RJ45 plug and carrier molding

7. Pull up the **connector body** and locate the **carrier**. The carrier sits into a 'D' shaped aperture in the connector body, make sure it's sealed correctly. Locate the **locking ring tool** and tighten **ring** to retain insert, using the assembly tool (locking ring tool) provided.

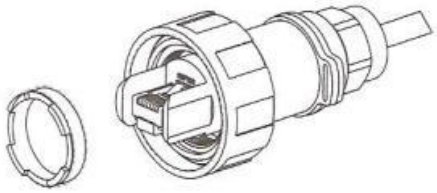


Figure 9: Locking ring and connector body

8. Slide **gland**, **gland cage** and **gland nut** up to the body moulding, and then tighten to torque of **1.5-2.0lb/ins**, **13-18 Nm**.

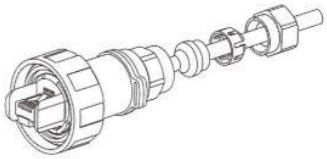


Figure 10: Gland, gland cage and gland nut

Flexible protective conduit cable

NOTE: It is recommended that you purchase the protective conduit cable prior to the next installation procedure.

Figure 11: Flexible protective Conduit cable

Power Supply (4 Pins – connector wiring)

The following table shows the power supply connections from the main power supply cable to the imaging unit.

Pin #	Description	Cable color	Input/Output Connection to
GND	Ground	Black	Input
1	24VDC input	Red	Input- Power
2			
3	Earth	Green/Yellow	Input to Enclosure

Table 1: Default power supply image/unit connection

NOTE: It is recommended to use a ferrule 1.8mm for each wire.

Figure 12: Ferrule

I/O connector (7 pins- connector wiring)

The following table shows the default wiring of the inputs (pins 1-6) and outputs to the laser/Loop detector cable wires.

Socket Pin #	Description	From Laser Wire Color	Input/output Connection to
1	Laser/Loop detector trigger	Green	IO Board Trigger
2	Gate – Normally Open	White	IO Board No
3	Ground – For laser/loop detector	Black	P.S. Board Ground
4	VCC – 24V for laser	Red	P.S. Board 24V
5	RS232 Rx for laser	Red	TX
6	RS232 Rx for laser	White	RX
G	Gate – common	Blue	IO Board Common

Table 2: Default laser connector connections

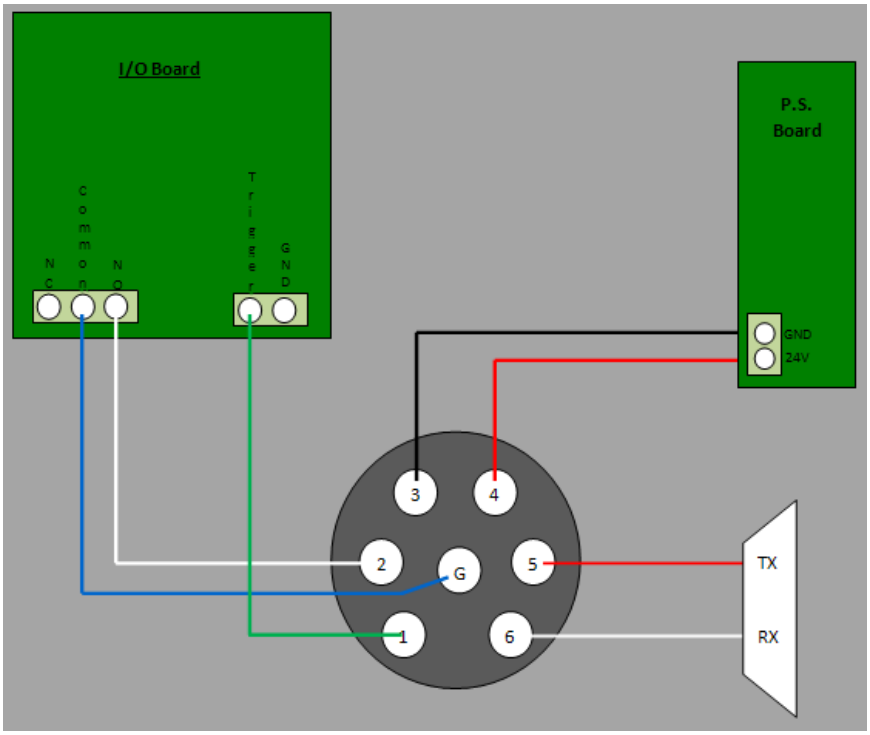


Figure 13: Control connector wiring

NOTE: Additional RS232 cable is connected internally, to control the laser via an external kit.

Connecting (optional) power supply

Follow the steps to connect the 3+PE cat number B-0210-00-04 binder to the optional power supply to the C50 or C6 camera.

1. Connect the **black** wire to the **negative (-)** and the **red** wire to the **positive (+)**.

Figure 14: Rear of optional power supply

2. **Connect** the **3+PE** connector cable to the **rear** of the camera.

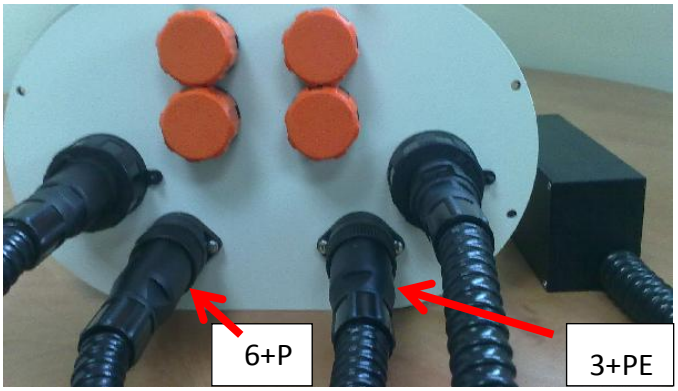


Figure 15: Rear view of C50 camera

NOTE: 6 +PE connector is for optional laser or loop control.

Chapter 3: Camera/Bracket Assembly

This chapter will show you the easy to follow step-by step procedure to install the bracket to the camera.

NOTE: For Gantry Design, the following bracket is being used:

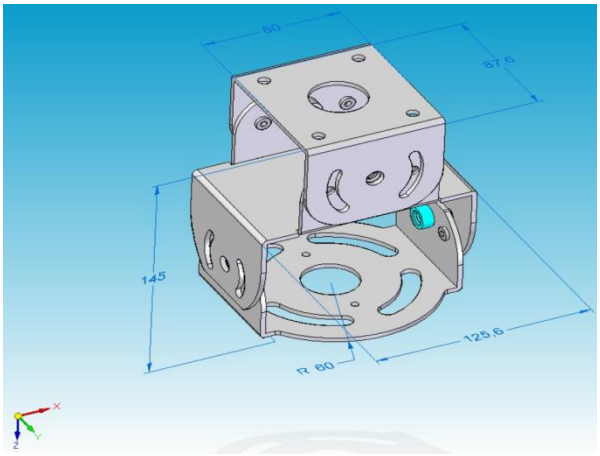


Figure 16: Dimensions of anodized bracket

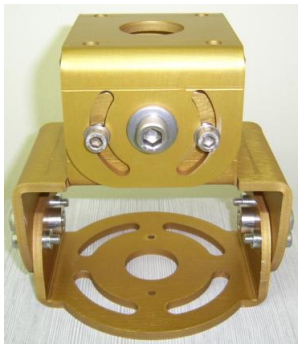


Figure 17: Assembled anodized bracket

NOTE: Three-piece anodized bracket is factory assembled.

To install bracket and camera assembly:

1. Unscrew and remove the **upper bracket**.

Figure 18: Upper bracket

2. Attach **upper bracket** to bottom of the camera and tighten screws.

Figure 19: Upper bracket attached to bottom of camera

3. Re-attach **upper** and **lower bracket** and tighten screws.

Figure 20: Upper and lower bracket attachment

4. Attach **bracket** to your **specified gantry**.

Bracket and Camera Installation on a Wall or Pole

The recommended angle between the C50 or C6 and the car is 15-16 degrees. The angle should not exceed 30 degrees. The camera should face downwards in order to minimize the sun's effect. Since most plates are mounted at a height of 0.20 to 1.25 meters, the recommended height for the C50 or C6 unit is between 1 to 1.5 meters. The maximum height at which the C50 or C6 should be installed is 3 meters. In this case, the camera should be positioned in such a way that the center of the vertical field of view is the trigger area. For higher installations, consult Hi-Tech Solutions.

You can mount the C50 or C6 unit on a wall, or install it on a pole or tripod. The following sections provide installation instructions.

To Mount a C50 or C6 on a Wall:

Follow the instructions as indicated in the following illustrations:

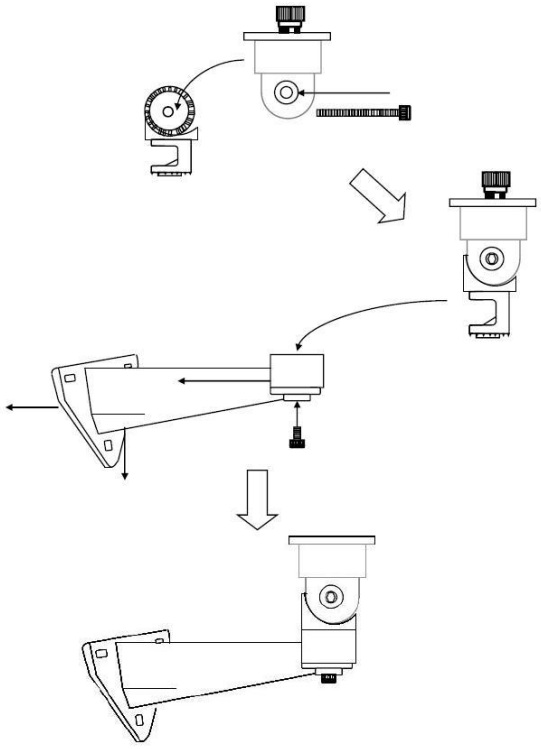


Figure 21: Mounting C50 or C6 on a wall

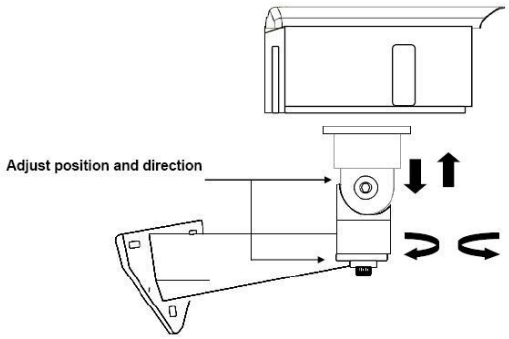


Figure 22: Adjusting C50 or C6 Position and Direction

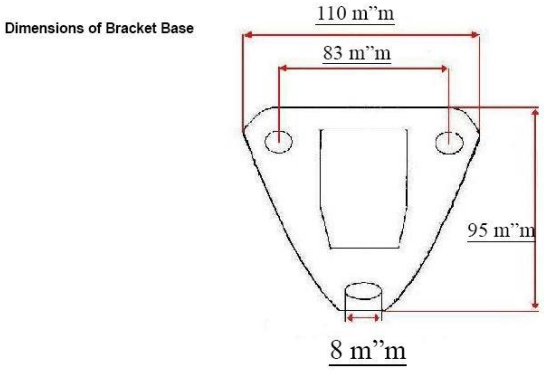


Figure 23: Location of Wall Mounting Holes for a C50 or C6 Camera

To Mount a C50 or C6 on a Pole:

To mount a C50 or C6 on a pole, use the BR-20 pole adapter. The pole adaptor includes two straps of different sizes to accommodate various pole measurements.

Attach the pole adapter to the pole using one of the straps. Tighten the strap.

Figure 24: BR-20 Pole Adapter

Connect the bracket base of the C50 or C6 to the pole adapter board. Use the three screws and nuts provided in the pole adapter kit.

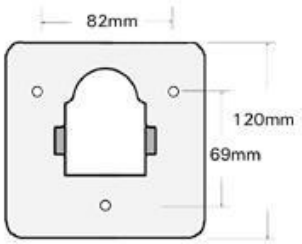


Figure 25: Screw Locations in the Pole Adapter

Chapter 4: Camera/Mobile PC Connection

This section will show you the steps to install the C50 or C6 camera to a laptop.

To connect the C50 or C6 to a laptop:

1. Plug in **LAN** connection on the **left side** and **3+PE** connector wiring as shown in the following figure.

Figure 26: Rear of C50 camera

2. Connect **LAN** connection **wire** to **laptop**.

3. Confirm **orange** lighting, by removing the two Allen screws (M5) at the top of the cover and remove the top cover plate.

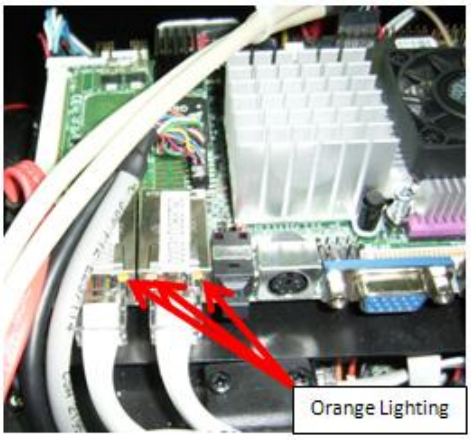


Figure 27: Interior of C50 camera

NOTE: Orange lighting in figure 20 above signifies 1 GB.

4. Connect to remote desktop.

    - From **start**
    - Select **Program**
    - Select **accessories**
    - Select **remote desktop**

5. Enter **default IP** number **192.168.0.50**. Click **connect**.

6. Enter username (**administrator**) and password (**hts**). Click **OK**.

Chapter 5: Software Application Settings

This section describes how to set the C50 or C6 application settings in order to obtain the best results. It assumes that all software, hardware and drivers are already installed.

To set application settings:

NOTE: There are three ways to access C50 or C6 settings as described below.

1. Click **File**. Select **Settings**.

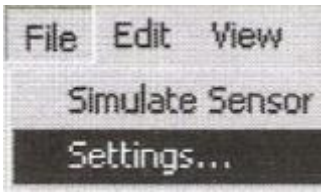


Figure 28: Main menu toolbar

2. Click **Settings** in the toolbar.

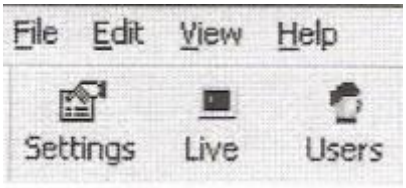


Figure 29: Main menu toolbar

3. Press **F8** hot key.

4. The **Settings** dialog box appears:

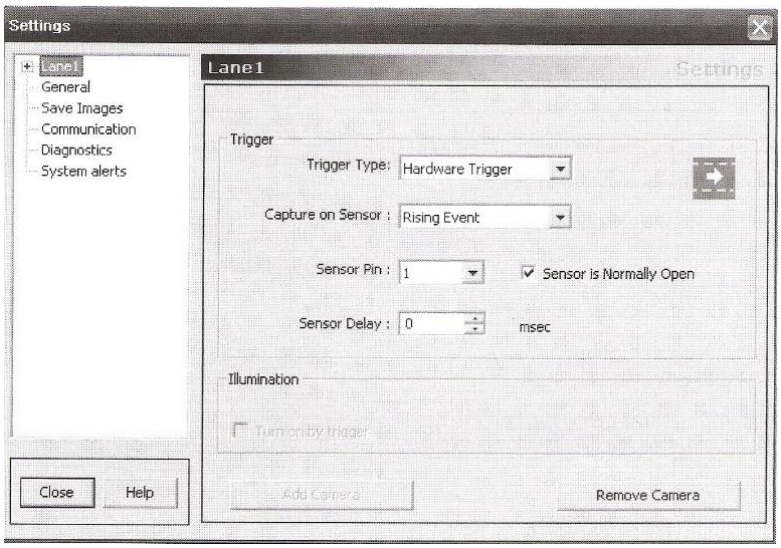


Figure 30: Settings dialog box

NOTE: C50 or C6 application default settings fit most of the installation cases.

Lane level

The number of lanes is always 1, since the C50 or C6 is a single lane system. Each of the parameters of the lane can be configured according to the installation requirements.

Lane Settings

The lane settings display is seen in the following page as Figure 23. It configures the lane with general parameters, and additional information is defined at a lower (camera level) setting.

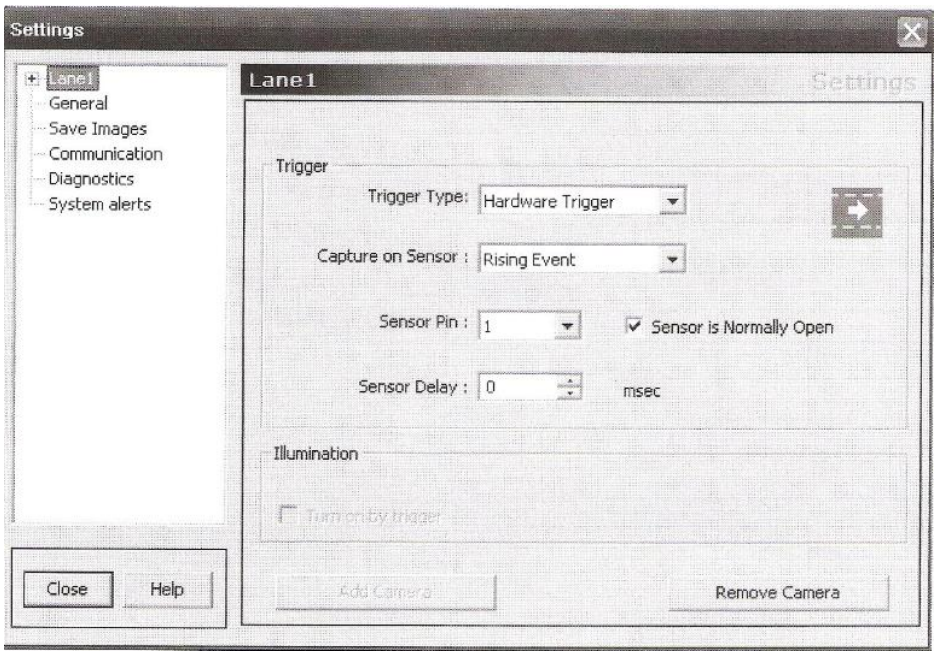


Figure 31: Lane settings dialog box

The window's components are described in table 3 below:

Parameter	Description
Trigger	
Trigger type	The type of trigger that initiates the recognition event. Hardware – Laser device that detects vehicle presence that is connected to the camera. The laser is connected only to one camera, so the user must select the correct camera. Software VMD – Implemented as part of this application. Triggers recognition when a vehicle enters a specified area of view.
Capture on sensor	When trigger type is "Hardware", this option controls the way input from the hardware trigger is interpreted. Default: Rising.
Sensor is Normally Open	This option must reflect the hardware loop detector setting. Please refer to the loop detector's user manual (for technicians). Default: Normally Open.
Sensor Pin	Unused – disabled.

Sensor Delay	Defines the time in milliseconds from the point that the vehicle enters the trigger point and until the application receives the trigger. According to this value, the application will use images captured X milliseconds before receiving the trigger. This entry is critical for fast moving vehicles in a case of a slow detector. Range: 0 – 200 ms. Default: is 0, which is good for a fast detector.
Illumination	
Turn on by trigger	Unused – disabled.
Last Name	The lane name editing is possible by editing lane label on the left tree control. It is similar to re-naming in Windows Explorer: make focus on the lane label by mouse click; by second click enter editing mode and change the label. The lane name is used only as a title for the C50 or C6 display.
Add Camera	Adds a camera to the application. Minimum one and maximum two cameras are allowed.
Remove Camera	Removes a camera from the application. Minimum one and maximum two cameras are allowed. You cannot remove both cameras.

Table 3: Lane settings parameters

Camera Level-Setting Dual or Single camera

These settings determine the configuration of the camera(s) in the system. Each C50 or C6 can have 1 or 2 cameras, and each is configured separately. The following figure shows a sample display, and its components are detailed in the following page.

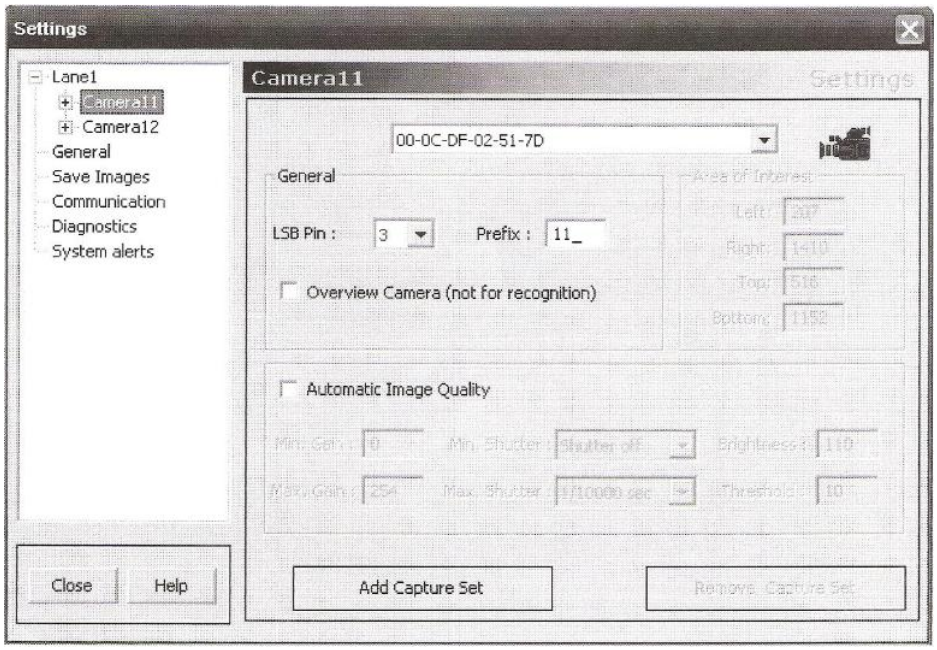


Figure 32: Recognition camera settings

Parameter	Description
Mac Address	Associates the camera to the lane by its MAC address, which is a unique identifier for the device. Changing this settings item must be done in a cautious way. There is no option to connect the same device to different lanes. The application will issue a warning when you assign the same MAC addresses for different lanes on the same PC, but it cannot determine if you assign the same MAC addresses for different lanes on different PC's. Default: This value is read from the device and should normally be left at its original value.
General	
LSB Pin	Associates the terminal block pin to the camera illumination control LSB (least significant bit). The MSB (most significant bit) is connected to the next pin. Defaults: 3 – 7.
Prefix	Defines the prefix for the image file name. Default: "xy" (where x is the lane number and y is the camera number) – e.g. "11" for lane number 1 and camera number 1.

Overview Camera	If checked, functioning as overview camera. Default: Not checked.
Area of Interest	Defines the area in the image that will be used for motion detection, if this feature is used. This only displays the area coordinates. To set this area, use Live Video window. Default: Full frame. Left – 0, Right – 1376, Top – 0, Bottom – 515.
Automatic Image Quality	When enabled, the auto – gain function is activated. This function maintains the brightness of the image to a desired brightness value, regardless of the changing environment, thus increasing the image quality at bad light conditions. The calculation is done on basis of a moving average of the last 10 vehicles. It will therefore adapt the camera signal gain to the changing environment light conditions. The mechanism repeats itself every 30 seconds until the desired brightness is reached or it meets one of the limits (minimum and maximum gain). If this option is enabled, the manual gain changing is disabled. Thus, the fields cannot be changed in Live – video and capture – set pages. Default: Disabled.
Min. Gain Max. Gain	Minimal allowed gain value, the system can set in the auto-gain function. Default: 0. Maximum allowed gain value system can set in the auto-gain function. Default: 254.
Desired Brightness	The auto-gain function target value. It defines the desired image brightness, where 0 is totally black and 255 is totally white. Default: 150.
Threshold	Allowed threshold for the desired brightness before system changes gain set direction. This value is used to prevent the auto-gain function to bounce up and down around the proper value. Default: 10
Add Capture Set	Adds a capture set for this camera.
Remove Capture Set	Removes a capture set for this camera.

Table 4: Recognition camera setting parameters

Capture Sets

For each capture set that is defined, the user can configure its settings using the following window which is opened while selecting the item under the camera settings.

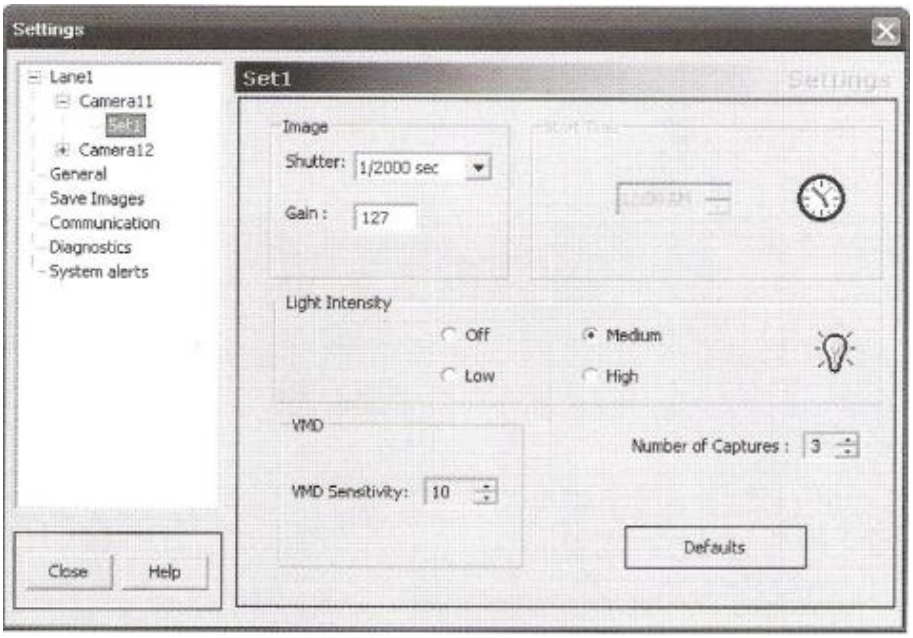


Figure 33: Capture set definition window

Parameter	Description
Image	
Shutter	Defines the camera shutter speed for the capture set. Range: Shutter off, 1/60 – 1/10,000. Default: 1/1000.
Gain	Defines the gain setting for the capture set. This option is disabled if auto gain is enabled. Range: 0 to 254. Default: 127.
Start Time	Defines the time of day to start this capture set. Not used in case of a single capture set. If another set is defined, the capture set will end at the start time of the next set. Default: 12:00 AM (noon time), not used in case of a single set.
Light Intensity	Defines the illumination intensity for the current selected set item. Four levels can be selected: off, low, medium and high intensity. This setting has no effect in case C50 does not control the illumination, such as in the case of an external lamp. Default: Medium.
Number of Captures	Defines the number of images to capture in the selected set. Range: 1 - 5 Default: 3.
VMD	
VMD sensitivity	The sensitivity level of the motion detection algorithm. Range: 1 - 20, while 1 is most sensitive. Default: 10.
Defaults	Sets the Illumination intensity to the default set; brightness, contrast and gain to default values.

Table 5: Capture set definitions parameters

General Settings

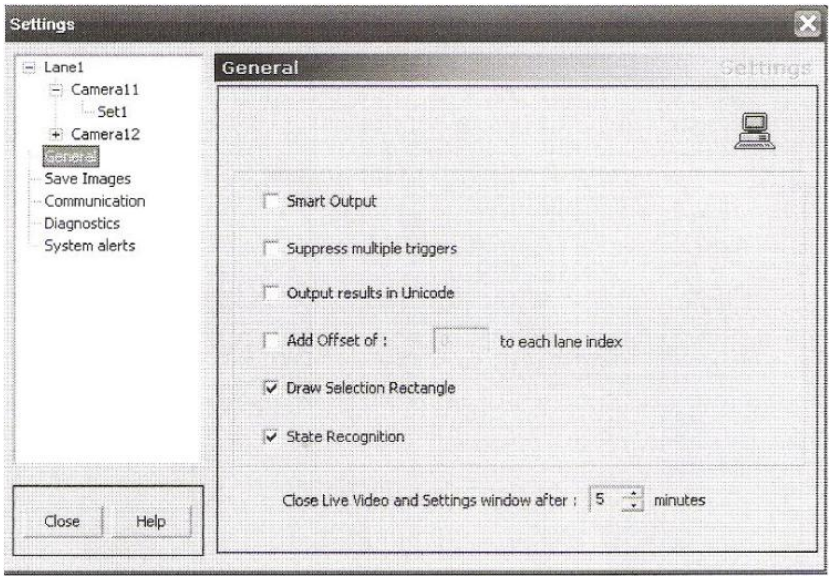


Figure 34: General settings

Parameter	Description
Smart Output	If set – the application will not send out recognition results if there is no recognition. Default: Not set (all recognition results are displayed)
Suppress multiple triggers	If set - the application filters recognition results made within a short time period. For example, if 2 results of the same vehicle are observed within a few seconds, then only the first recognition is reported. Default: Not Set
Output results in Unicode	If set – the results are set to Unicode (used in Korean and other special language sets). Default: Not set
Add Offset of x to each lane index	Adds an offset to the reported lane number. This is useful when clustering PCs. Default: 0 (No offset)
Draw Selection Rectangle	If set – the Area of Interest (AOI) is drawn on the images in the images view. Default: Set.
State recognition	If set – performs State recognition. Note that this mode requires a special license. Default: set.
Close Live Video and Settings window after x minutes	When either Live-Video mode or the Settings window is on, the recognition process is stopped. In order to prevent the system to remain in this state, an automatic process limits the time when these diagnostic/setup windows are on. After this time the application reverts back to normal recognition operation. Range: 1-15 minutes Default: 5 minutes

Table 6: General settings parameters

Save Image Settings

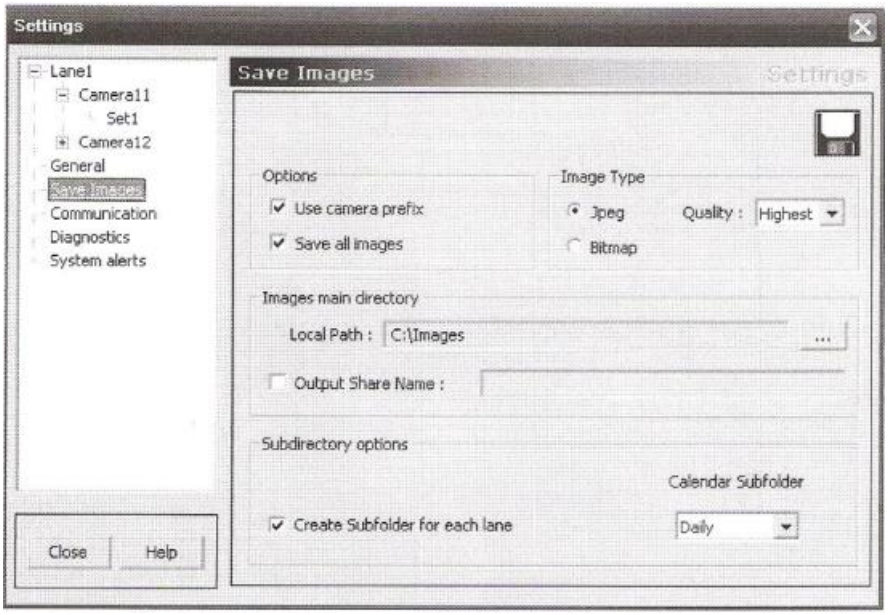


Figure 35: Save images

Parameter	Description
Options	
Use camera prefix	If set, adds the camera prefix to the image file name. Default: Set.
Save all images	If set, save all intermediate images (as defined by the capture sets for all the lane's cameras). Default: not set (saves only the 'best' image).
Image Type	
Jpeg	If set – saves the image in Jpeg compressed format. Default: Jpeg
Jpeg Quality	Defines the quality level of saved jpg image. A higher quality looks better but is greater in size. Typical sizes: 12KB for low and 40 KB for Medium. Default: Medium.
Bitmap	If set – saves the image in bitmap uncompressed format. Default: Jpeg.
Images main directory	
Local Path	Defines the local disk path where the images (and their sub–directories) are stored. User can use the browse button ("…") to select the path from the existing disk directory, or type a new path. The application will create the directory if it does not exist. Default: Working directory.
Output share name	If set – a network shared name can be defined in order to set the reported image path to a network drive. This is useful if the message containing the image path is transmitted over the network, so the remote node could access the image file name using the absolute path. Default: Not set (image path is reported as a local drive)
Subdirectory options	
Create Subfolder for Each Lane	If set – the application opens a separate subdirectory for each of lanes. Default: Create
Calendar Subfolder	The application can open a periodical (Daily / Weekly / Monthly) subdirectory under the images root directory path. Another option is "None" if no subdirectories creation is desired. Default: Create Daily (will open a new subdirectory every midnight).

Table 7: Save images parameters

Communication Settings

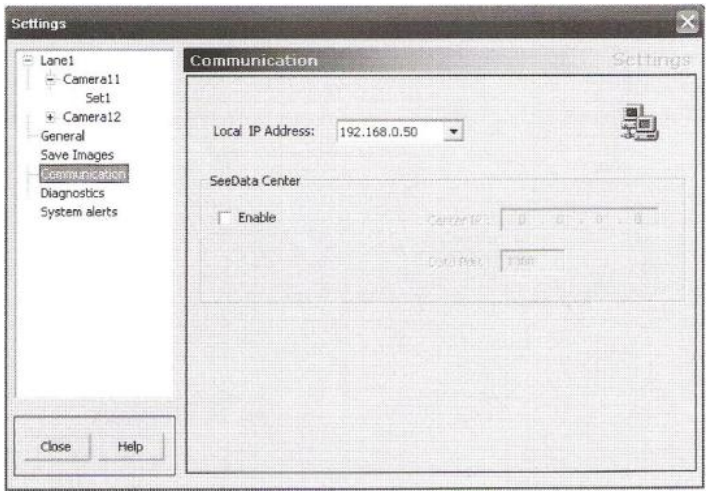


Figure 36: Communication settings

Parameter	Description
Local IP address	The local PC's TCP/IP address. Choose the desired IP address
SeeData Center	
Enable	Activates the network-communication option. Default: Disabled.
Center IP	The host PC TCP/IP address for sending recognition results. Default: 0.0.0.0
Data port	The host PC TCP/IP listening port number. Default: 1368

Table 8: Communication settings parameters

Diagnostics Settings

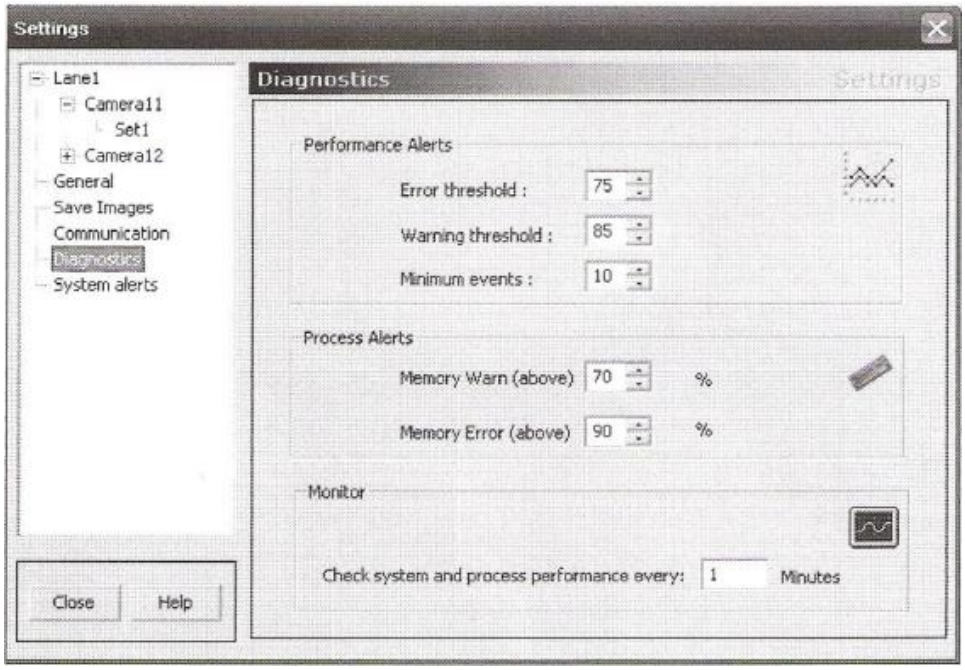


Figure 37: Diagnostics setting box

Parameter	Description
Performance Alerts	
Error threshold	Defines the threshold to set an error alert in case of low recognition. The error is recorded in the application Event log and will show as a “red” state in the SeeMonitor utility. When the recognition rate increases, the application will write an information event that cancels the error. Range: 0 – 100 (0 will not generate errors). Default: 75
Warning threshold	Defines the threshold to set a warning alert in case of low recognition. The value is lane specific, and is calculated as the percent of recognized events within the last number of defined “minimum events”. For example, 21 recognitions out of 25 events yield 84% recognition accuracy. The warning is recorded in the application Event Log and will show as a “yellow” state in the SeeMonitor utility. When the recognition rate increases, the application will write an information event that cancels the warning. Range: 0 – 100 (0 will not generate any warnings. Default: 85
Minimum events Process alerts	Sets the size of the performance group. This value is used to calculate the recognition rate for the warning and error alerts. Default: 25

Memory warn	Sets the value of C50 or C6 memory usage level from which the system writes a Warning message to the system's Events Log. If the C50 or C6 memory usage is back to normal range, the system writes an Information message. Default: 600
Memory Error	Sets the value of C50 or C6 memory usage level from which the system writes an Error message to the system's Events Log. If the C50 or C6 memory usage is back to normal range, the system writes an Information message. Default: 900
Monitor	
Check system and process performance every X Minutes	Sets the time's frequency of the diagnostic checks. Default: 1 Minute

Table 9: Diagnostics setting parameters

System Alert Settings

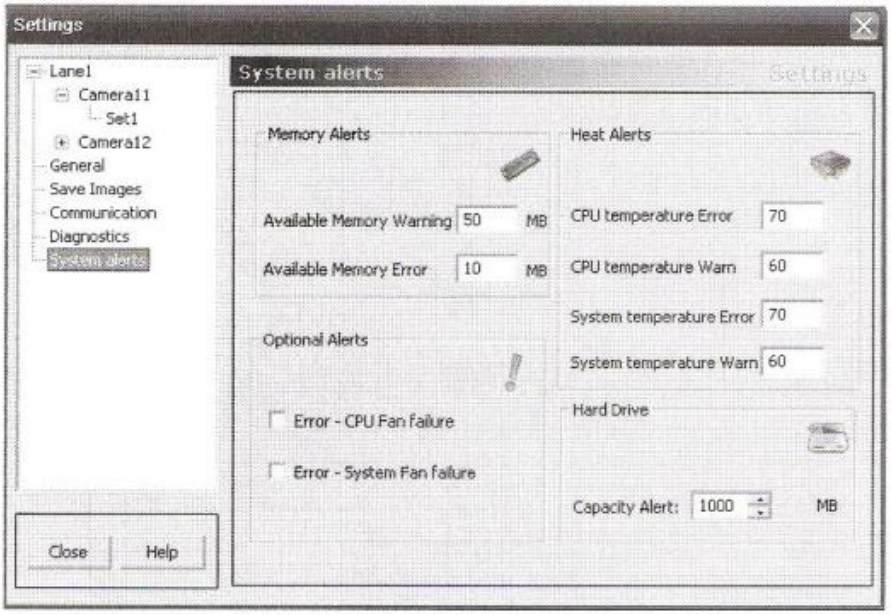


Figure 38: Systems alert settings dialog box

Parameter	Description
memory Alerts	
Available memory warning	Sets the value of Free Memory usage level from which the system writes a Warning message to the system's Events Log. If Free Memory usage is back to normal range, the system writes an Information message. Default: 10MB
Available memory Error	Sets the value of Free Memory usage level from which the system writes an Error message to the system's Events Log. If Free Memory usage is back to normal range, the system writes an Information message. Default: 50MB
Heat alerts	
CPU temperature error	Defines the threshold temperature [in Centigrade] to set an alarm (error or warning) in case of overheating (CPU or system) Default: 70c (error) / 60c (warning)
CPU temperature Warn	As CPU temperature error
System temperature error	As CPU temperature error
System temperature Warn	As CPU temperature error
Optional alerts	
Error – CPU fan failure	Enables the indication of a failure of the CPU fan. Default: enable.
Error – system fan failure	Enables the indication of a failure of the C50 system fan. Default: Disabled
Hard drive	
Capacity alerts	Defines the threshold disk capacity (in MB) to set an alarm (error or warning) in case of low disk space. Default: 1000MB

Table 10: Systems alert settings parameters

Chapter 6: Single Camera/Dual Cameras – on site Calibration and Fine-tuning

General Information

Before calibration on site, please note:

Lane closure – For cameras fine tuning, the lane should be closed. Make all preparations for the lane to be closed such as road blocks and flashing lights.

Safety preparations must be taken to insure the workers safety, such as safety shoes and reflecting vest.

This chapter will describe the arrangement for calibrating C50 or C6 imaging unit cameras on sites.

NOTE: This setup is for the cameras and laser; it should be tested both at night and daytime.

NOTE: If the installation is for Dual cameras, the B/W camera should be selected as the first camera (camera 11) and the second camera will be the color camera (camera 12).

Cameras calibration

The following diagram presents a typical installation on gantry. The C50 or C6 imaging unit will be installed as per the following top view diagram.

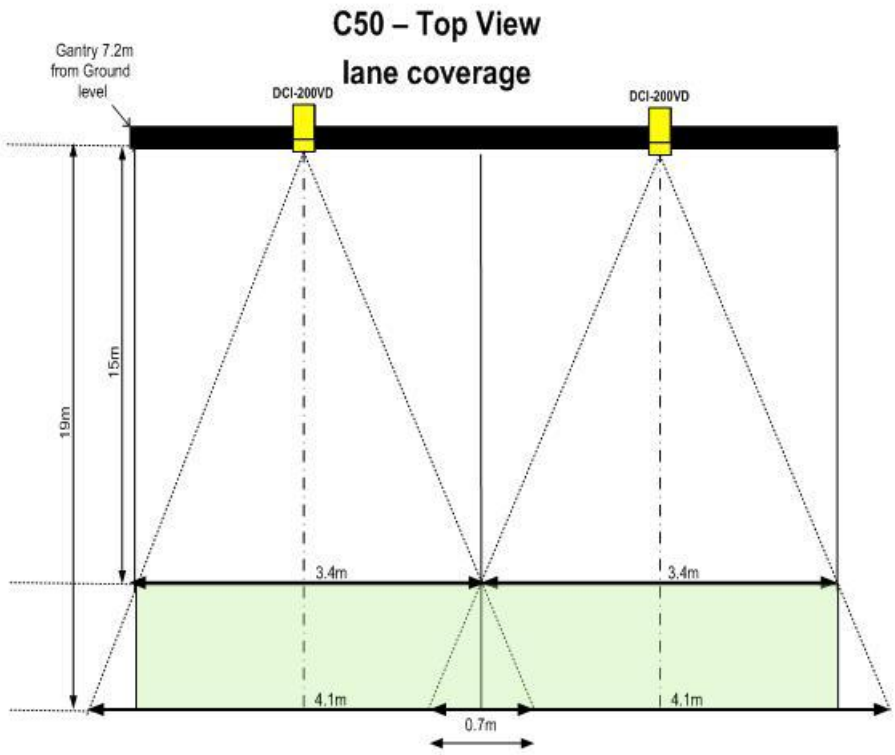


Figure 39: Imaging unit location design (lane coverage)

NOTE: HTS recommends an installation height between 5.5 – 7 meters.

For maximum lane coverage, mount the camera in the middle of the lane.

Do the following preparation before starting the adjustment:

1. On the gantry; Use extra Ethernet cable (1Gb) from the C50 or C6 to a laptop and use **remote desktop** to operate the LPR application use the following IP number **192.168.0.201;** sub net **255.255.255.128**.

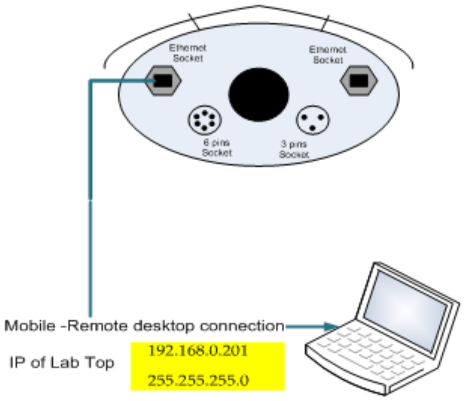


Figure 40: Remote desktop connection

2. Connect via remote desktop. Connect to default IP number **192.168.0.50** of the C50 or C6 imaging unit. Enter User Name **administrator** and Password **6441870**.

Calibrating first camera- B/W Camera

The step-by-step procedure below will show you how to calibrate the B/W camera.

To Calibrate the B/W camera:

1. Run the C50 or C6 application and Calibrate **B/W camera** FOV. Using the **live video** of C50 or C6 application, activate from the live screen default button and select the tab of **B/W camera 11**. Adjust **Gain level** and **brightness**.

2. Verify that B/W camera is in tilt distance of **15 meters** (L = 15m; H=~3.4m); If needed, Pan the **mounting bracket** to middle of the lane.

NOTE: The distance on the road of 15m depends on the height. It should be double the height depending on the lens.

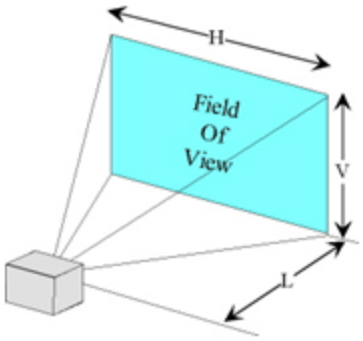


Figure 41: FOV LV H parameters

3. Use paint brush to measure the plate size image **~180 pixels** for short plate, **(~340 pixels** for long plate). The Width = **150, Length~60**.

4. Focus **B/W** by **zooming plate**.

NOTE: It is recommended to place a car in the middle of the lane.

5. Move the focus lens ring right and left until you find a sharp plate at the middle of the FOV.

Calibrating second camera- Color Camera

This section will show you step-by-step how to calibrate the color camera with relative ease.

To Calibrate the Color camera:

1. Move to **live video screen** and select the tab of **Color camera**.

2. Verify Color camera tilt **L = 15m; H=~3.4m**; Pan to **middle of the lane**.

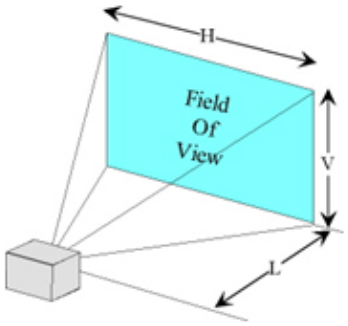


Figure 42: FOV LV H parameters

NOTE: The distance on the road of 15m depends on the height. It should be double the height depending on the lens.

3. Use **Left button** on mouse to mark the plate size and measure on the **left side** of screen **~150 pixels** for **short plate ~250 pixels** for **long plate**.

NOTE: For the color lens you can zoom in and out the lenses.

4. Focus Color by adjusting focus lens, by zooming one digit.

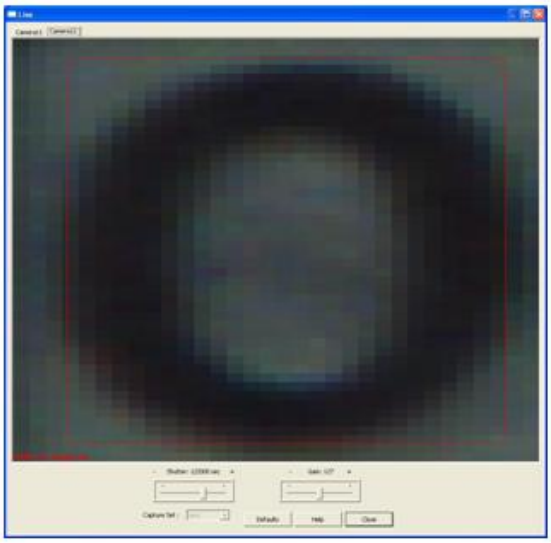


Figure 43: Focus lens

Live Video Mode

Live video is used for setting up the camera, or checking its operation. During this mode the recognition and normal operation is stopped.

There are three ways to open Live Video.

1. Select **View**, and then **Live Video**.

Figure 44: Main menu

2. Click on the **Live Video** in the **Tool Bar**.

Figure 45: Live video on tool bar

3. Open Live Video with the **F10 hot key**.

Figure 46: F10 hot key on keyboard

An example of a live video display is seen in the following diagram:

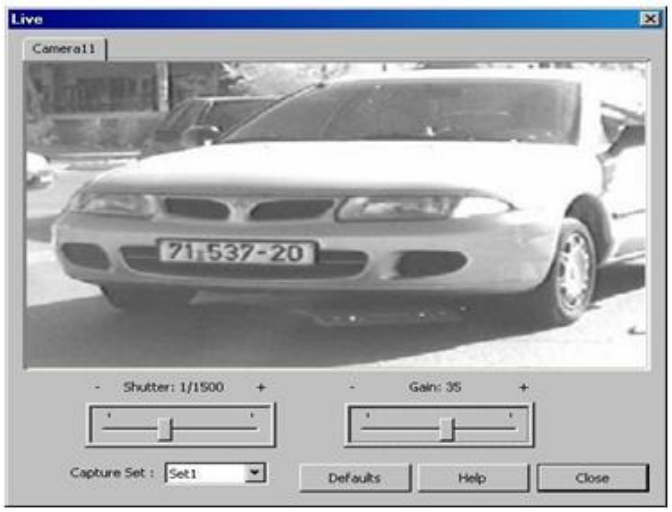


Figure 47: Live video

Recognition Camera Setting (Shutter and Gain)

Parameter	Description
Gain	Sets the iPort's gain. Slide left or right to adjust the value, which will change the settings for the live video. The updated parameter will also be saved and used as the current gain level, unless auto gain is used. Range: 0 to 254 Default: 127
Shutter	Sets the iPort's shutter. Slide left or right to adjust the value, which will change the settings for the live video. Range: Shutter Off, 1/60 – 1/10,000 Default: 1/2000

Table 11: Recognition camera settings

Chapter 7: VMD Software Trigger - on site calibration & fine-tuning

This chapter describes the Video Motion detection setting. VMD is an internal feature that works on the Infra-Red C50 or C6 camera.

Defining the Area of Interest

The Area of Interest (AOI) is the area in which the license plate recognition (LPR) is active. The AOI is a rectangle, which its sizes are equal or less than the whole image size. If the vehicle's license plate location is outside the AOI range, LPR will not happen even if the car is shown in the image.

This feature is designed to avoid cases in which two cars are very close and one of them is recognized in more than one lane while the second car is not recognized at all.

NOTE: The AOI is used for VMD not for recognition.

For example, assume we have two lanes. In the left lane, the image includes only one car with the plate "60 ATZ 60"while in the right lane the image includes two cars with plates "60 ATZ 60"and "48 ASJ 60" In the left lane there is no problem (only one car) while in the right lane there is a chance that the result will be the left car and not the right car. Thus, it results with a missing LPR. This is prevented using the AOI settings.

Figure 48: 2 cars in single lane with left car invading the right car's lane

Draw the AOI on the Live Video

Use the mouse to draw the rectangle by holding down the left button and dragging the mouse until you reach the desired AOI.

A menu with two fields **SET** and **CANCEL** will pop up and you now need to select whether to accept the AOI (the rectangle does not disappear) or to cancel (the rectangle disappears).

You can set the rectangle as many times as you like until you are satisfied with the AOI. The area must exceed **300 X 200 pixels**. If the drawn area is smaller, the rectangle is drawn but it cannot be set.

Figure 49: The AOI before setting it

In the above image, we can see AOI that can prevent the situation.

Chapter 8: Hardware Trigger – Laser Trigger

This chapter will present calibration of the Laser hardware trigger.

Laser Trigger configuration

Figure 50: Laser

The wide-beam measurement laser, with a wide-stripe `fanned' beam output, detects a vehicle's presence and sends a pulse trigger to the B&W camera which also sends feedback from the camera to the software application.

Technical Specifications:

- Power Input 24 volts DC <5 watts, Data Output Serial RS232 at 9600 baud
- Measuring Rep Rate 1000 Hz, Accuracy +/- 15 cm (typically), Passive Range 0.3 m to 30 m
- Laser Beam Divergence 130 x 0.2 mrad (typically)
- Protection Class IP67
- Storage Temp -30°C to +90°C
- Operating Temp -20°C to +60°C
- Dimensions (LxWxH) 114 mm x 54 mm x 43 mm
- Weight 300 g, Construction - Anodized Aluminum
- Registered in Scotland

Laser installation

The laser element will be installed per the following side view diagram:

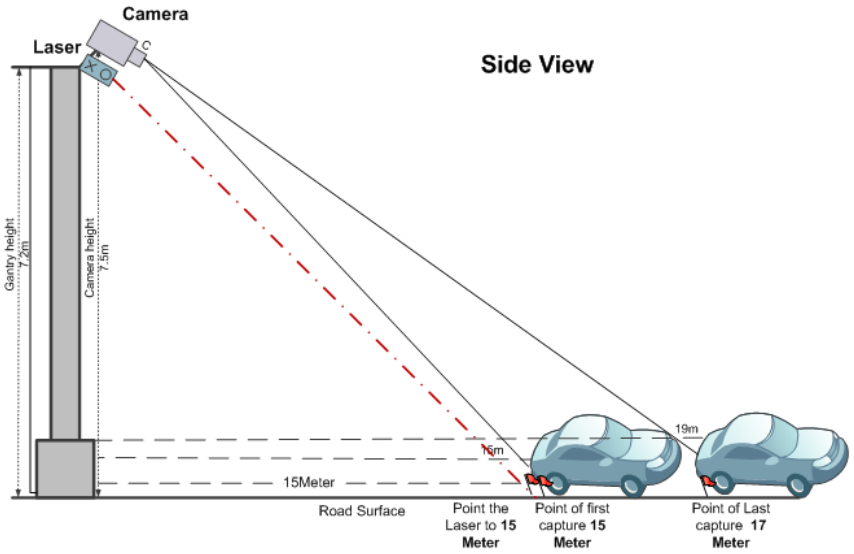


Figure 51: Imaging unit location design (distance from camera to plate)

- First position the cameras and laser units toward the proper location on the road.
- Secondly, on the road, at the first detection line; place one reflective plate or use a vehicle at the center of the required field of view (two more plates on each bottom corner of the required field of view are optional).

Laser Setup

The setup of the Laser is already done at MDL factory, but it may be necessary to update the settings in the future. The overall general operation is quite simple, after positioning to the correct distance, connecting the power connector of the laser to the camera housing socket; the laser will then be adjusted automatically.

Laser configuration

1. Preparations

1. Prepare: C50 or C6 camera head.
2. On the gantry; Use extra Ethernet cable (1Gb) from the C50 or C6 to a laptop and use **remote desktop** to operate the LPR application use the following IP number **192.168.0.201;** sub net **255.255.255.128**.
3. Connect laser to the camera head.
4. From the C50 or C6 embedded desktop, start MDL laser SW.

2. MDL Laser Configuration sequence

1. Start the MDL configuration SW.
2. Make sure the setup tab is selected.
3. During the following uploads and downloads, make sure the operation is successful with no error message.
4. Upload the configuration (using Upload configuration button) from the laser.
5. Open the latest version of the configuration file from the disk.
6. Download the configuration (using Download configuration button that mark in red in the following image) to the laser.

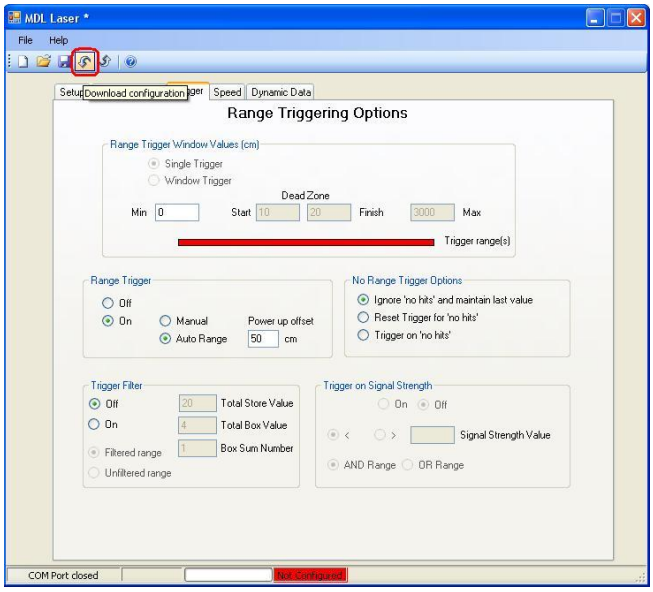


Figure 52: Range Triggering Options

7. Upload the configuration from the laser again.
8. Verify that all parameters are as in the following pages.

If any parameter is different from the following figures, do this sequence again.

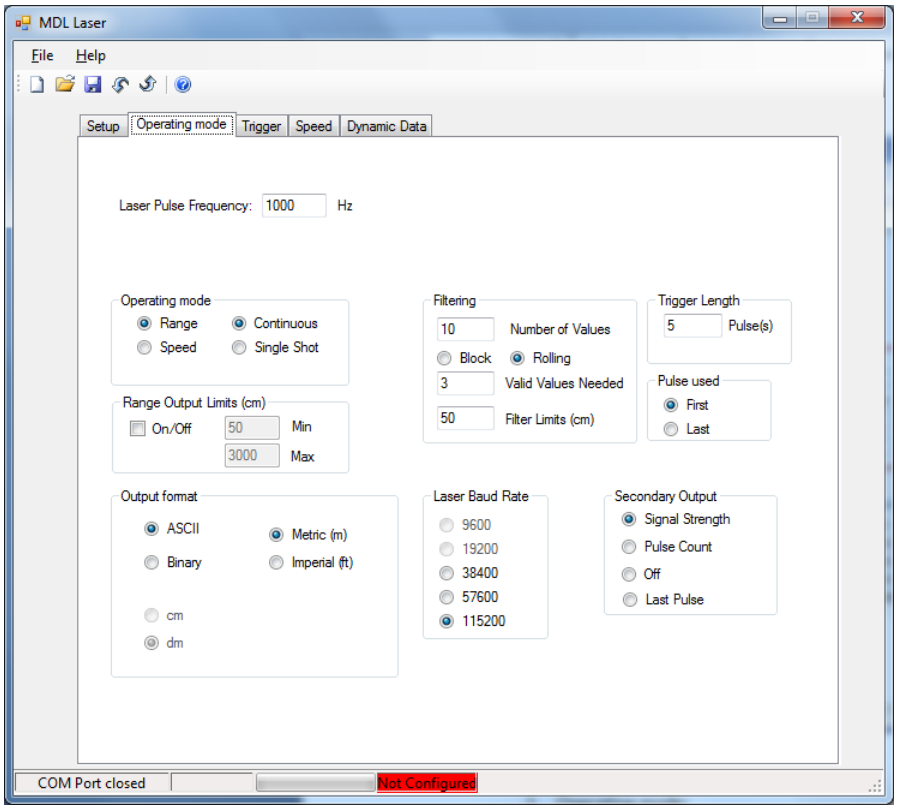


Figure 53: Operating mode tab

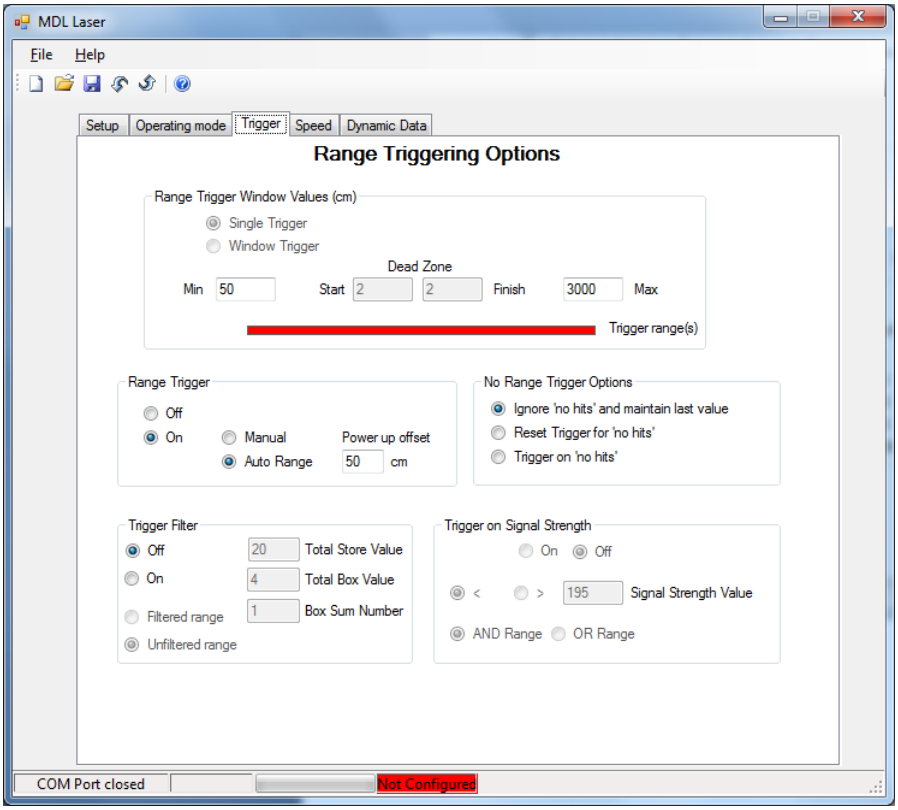


Figure 54: Trigger tab

NOTE: The Dead Zone parameters may change after upload.

On site laser calibration & test sequence:

- Make sure the communication on PC is 1 Gb.
- Make sure laser cable to camera is disconnected
- Set the cameras in front at distance of 15 meters and set the laser to the same direction.
- Run the C50 or C6 application and verify that both cameras display image in the live view.
- Verify all four (4) white LEDs and all four (4) IR LEDs are working.
- Point the laser to the same distance -15 meters (before power on) make sure there is no vehicle in the laser zoon and connect the laser to the C50 or C6.

- Block the laser with your hand and make sure that the C50 or C6 imaging unit reports on one trigger rising.
- Remove your hand and make sure that the C50 or C6 imaging unit reports on one trigger falling and initiates an event.
- Repeat last step ten (10) times.

Chapter 9: Hardware Trigger - Ground Loops Trigger configuration

This Chapter describes the procedure of installation and testing the C50 and C6 and the ground loops trigger.

Preparations

- C50 and C6
- Ground loop Trigger
- Ground loop controller
- PC, Monitor, keyboard and mouse.(or mobile pc)
- Vehicle to operate the trigger, (simulate as a target)

Installation Location Considerations

You can install the C50 or C60 so that it will capture an image of either the front or rear of a vehicle. The probable reasons for a rear installation include:

Front installation is not possible due to traffic lane limitations. For example, the front area is located in a public area in which no installation is permitted.

Vehicles carry only rear license plates. This is true for most of the United States.

Step 1 – Determining Pole or Gantry installation

The pole set-up is referring to Mid speed and access control installation.
A Gantry set-up is planned for high-speed system installation. In this case, the loop distance will refer to the distance from camera to the plate.

Step 2 – Determining C50 or C6 Location

The location of the C50 or C6 depends on whether you're installing it to capture an image of the front of a vehicle or its rear.

Determining Front Installation Distances

1. **Front determining installation For Access control:**

Install the C50 or C6, 2.5 meters from the barrier, in the direction of traffic, at the side of the lane as near as possible to the lane. For non-reflective plates and USA size plates, install the C50 or C6 2 meters from the barrier.

The distance from the C50 or C6 to the license plate of the car should be 7.5 meters for a plate length of 50 cm, or 6.5 meters for a plate length of 30 cm.

NOTE: If motion detection is used instead of a loop detector, the loop area in the illustration indicates the desired area of detection.

WARNING: A possible problem is that the barrier blocks the effective recognition view zone, which is the area from the start of detection. In most gates, the barrier's height is 0.80 to 1.20 meters, so no blocking occurs. However, this should be tested and avoided if necessary.

Try to install C50 or C6 as close as possible to the traffic lane, within 0.4 to 0.5 meters. Do not install them too close, otherwise they could get damaged. You can install them on either side of the traffic lane.

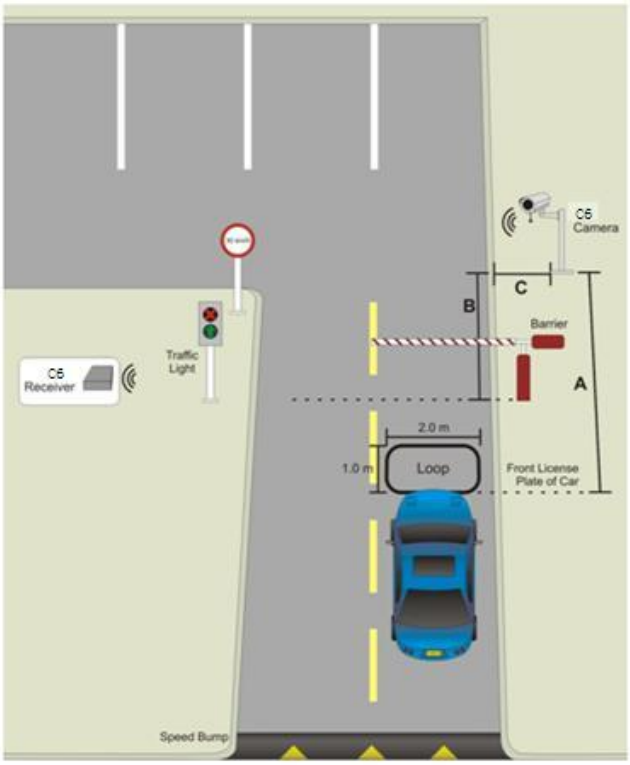


Figure 55: Front Installation Distances

2. **Front determining installation for Gantry Design:**

In this case, the loop distance will refer to the distance from the camera to the plate. Recommended distance is 15 meters.

Determining Rear Installation Distances

1. **For Access Control:**

Install the C50 or C6 4 meters from the loop detection line (**B**). This translates to about 9 meters or more from the front of the car since a typical vehicle is about 4 meters long. Try to install the C50 or C6 as close as possible to the traffic lane, within 0.0 to 0.5 meters (**C**).

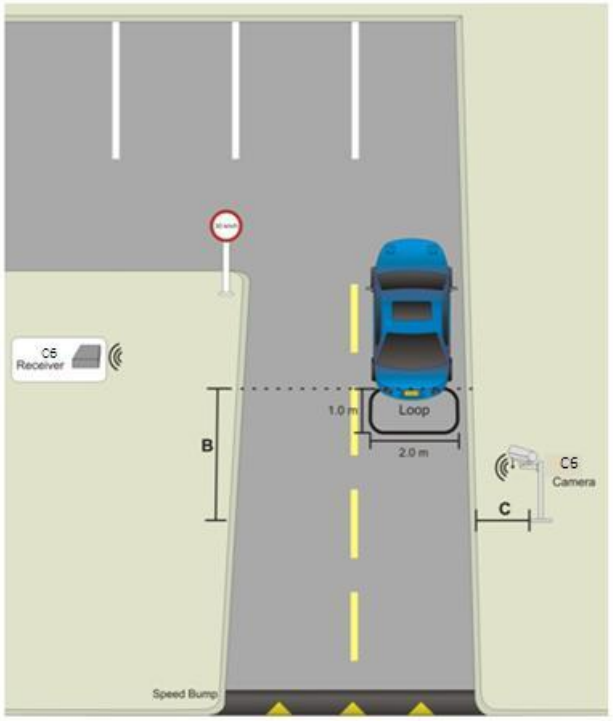


Figure 56: Rear Installation Distances

2. **For Gantry Design:**

In this case, the loop distance will refer to the distance from camera to the plate. Recommended distance is 15 meters.

Physical Installation

This section describes the physical installation of a single lane C50 or C6 system.

Step 1 – Installing a Loop Detector

It is assumed that the loop detector is a magnetic-loop detector type, about 1 m x 2 m. Consult with HTS for recommended loop detectors. Follow (*Appendix C: Ground Loop, Specifications & user guides*) for exact installation instructions.

This step is relevant for an access-control system installation in which a loop detector is used. Skip this step if you are installing an access-control system using the C50 or C6 internal motion detector, or if you're installing a laser trigger system.

For an access-control system, it is also advised to use speed bumps to slow down the traffic and to avoid bumper-to-bumper cases which might cause detection failures. Consult HTS for a solution in these cases.

Step 2 – Performing Electrical Connections

Perform the following electrical connections.

Sensor/gate (optional input and output) – Connects to the sensors and gate. The two pairs of connections are for the gate (output) and for the sensor (dry contact input).

P/S Power Supply (input) – Gets 24 VDC from the power supply unit, which feeds from the 100-200 VAC mains.

LAN – Connects C50 or C6 to a wire or wireless network connection.

Step 3 – Fine Tuning the Loop Detector

It is recommended to use loop detectors with a fast response time of less than 50 msec. Factory default settings are normally set to medium sensitivity. To fine tune the detector to the size of the plate, increases and decrease the sensitivity.

Increasing the sensitivity causes the loop detector to detect the vehicle when it is relatively far. The result is that the plate looks relatively small in the captured image. To decrease the plate size, increase the sensitivity.

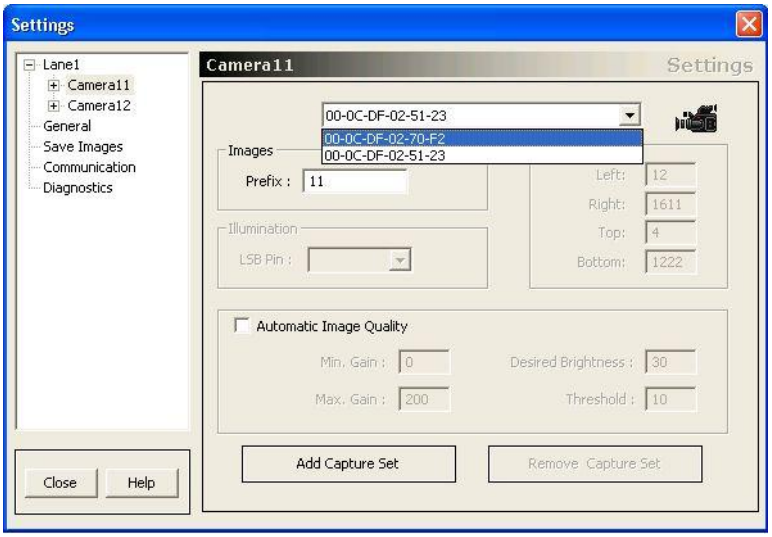
Decreasing the sensitivity causes the loop detector to detect the vehicle when it is relatively close. The result is that the plate looks relatively large in the captured image. To increase the plate size, decrease the sensitivity.

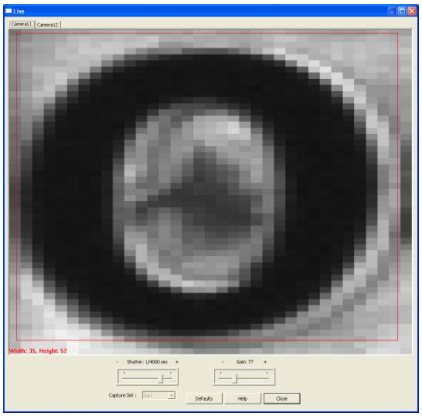
Chapter 10: QC- calibration check list form

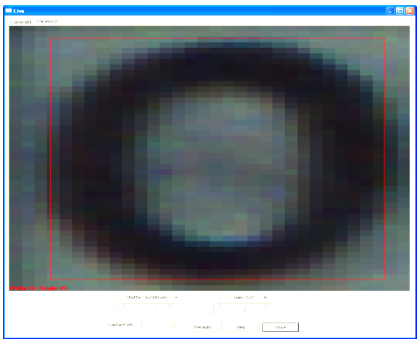
Site/Gantry/Lane Id: _____

Camera Head Serial Number: _____ Installation Date: _____

Installer Name: _____ Installer Signature: _____

Step	Operation	Description	
1.	Connect laptop	Connect laptop to the DPU with long Ethernet cable and make sure the connection is 100Mb or more.	
2.	Connect laser cable	Connect the RS232 cable between the laser and the C50 or C6 and to the laptop serial port.	
3.	Assign the cameras	Open the live image. Make sure the B/W camera is assigned to camera 11 and the color to 12. If not, change the Mac address in the settings dialog, exit the SW, run it again and check the camera assignment. 	
4.	Test laser signal strength	Put the laser pointer above the connected laser and assure that it's pointing to the middle of the lane. Then connect the laser communication cable and read the range measurements. Make sure the laser's readings are stable up to 18m.	
5.	Locate a plate at 15m distance	Locate a vehicle at 15m distance on the road from the gantry at the middle of the lane.	

6.	Adjust the tilt	Open the live view. Tilt the camera head until the plate is at the bottom of the b/w image.	
7.	Adjust the pan	Change the shutter of the color camera to off in order to see the lane clearly. Pan the camera head until both sides of the lane are equally in the image of the color camera. Attach a laser pointer to the laser and make sure the red dot is in the middle of the lane.	
8.	Fix the pan & tilt	Tight firmly the screws of the pan and tilt. Make sure again that the pan and tilt are as before.	
9.	Focus B/W camera	Fully open the B/W iris. Change the shutter speed to have a good contrast on the plate. Zoom in the live image to the plate until there are one or two characters. Change the focus to get the sharpest view where each pixel is separated in black or white (less gray pixels near the character).  **Make sure that focus for the whole plate is now sharp.**	
10.	Set B/W camera iris	Change the shutter speed setting and gain setting to the default (shutter = 2000, gain = 127). Close the iris to get the best contrast.	
11.	Measure plate size	Zoom out by right mouse button and measure the plate width on the B/W image. Make sure it is 150 (±7) pixels for 30cm plate or 250 (±10) pixels for 50cm plate.	
12.	Zoom color camera	Switch to live view of the color camera. Change the shutter speed to 4000 or more; set the gain to get the best contrast on	

		the plate. Measure plate width and make sure it is as the B/W camera (± 5 pixels). If not zoom in/out until it is. Some of the color cameras were zoomed out too much and included almost three lanes. In this case the plate is too small for recognition. ***Example of Bad Zoom Out***	
13.	Focus color camera	Zoom in to the plate until there are one or two characters. Change the focus to get the sharpest view where each pixel is separated.  ***Example of Good Zoom Out***	
14.	Adjust the laser (This step is only if there is Laser Trigger)	**1.** Attach a laser pointer to the laser and adjust vertically and horizontally to the middle of the lane. The red point should reach the height of the license plate or slightly below. **2.** Keep the road clear. **3.** Disconnect and connect the laser. **4.** Move a vehicle slowly back and forward. **5.** Make sure the system is triggered when the vehicle clears the trigger detection line (on trigger falling). **6.** Repeat steps 2-5 and adjust the laser vertically until the license plate at the first image is at the bottom of the image with some margin.	

		7. Configure the laser to **manual range** as described in **Appendix B**. 8. Disconnect the RS232 cable from the laser and connect the laser directly to the C50 or C6.	
15.	Check the Trigger (For all hardware triggers)	Move a vehicle slowly back and forward. Make sure trigger is stable: • One Rising • One falling Both at the right time and that all B/W and color images are at the bottom of the image.	
16.	Verification	Repeat step **15 ten (10) times**.	
17.	AIQ on B/W image	Turn on the **automatic image quality** option of the B/W camera. Make sure this parameter is turned off in the color camera.	
18.	Tighten screws and clean C50 or C6 window	Tighten all screws firmly and clean the front window of the C50 or C6	
19.	Verification	Repeat step **15 two (2) times**.	
20.	Open lane for real traffic	Open the lane for **real traffic**. Make sure that all the vehicles are being triggered by the C50 or C6, and verify that recognition is correct by comparing the OCR result with the image.	
21.	Verification	Repeat step **20** for at least **ten to twenty** (10-20) different **vehicles**.	
22.	Close up	Sign on this check list form	

NOTE: If equipment, including computer, camera head or laser is not functioning correctly, replace them immediately while installing and send them as RMA.

Chapter 11: Support and More Information

Contact Information

You can contact us for more information and assistance at:

Hi-Tech Solutions	Industry Rd, Ramat-Gabriel Industrial Park P.O. Box #133 Migdal-Haemek Israel 10500 Internet http://www.htsol.com Email support@htsol.com Israel.....Tel (+972) 4-6441890 Israel.....Fax (+972) 4-6441970 Technical Support Telephone Hours: Sunday – Thursday, 9AM – 6PM (GMT +2)

Appendix A: IP configuration

This appendix describes the procedure of configuring the C50 or C6 to work with the Data Center.

LAN connection:

- Set IP addresses according to the IP scheme and rename to LAN1.

Configure lane ID:

- Go to C50 or C6 settings → General tab and check the **Add offset**. Write the lane ID in the offset text box according to the lane ID scheme.

  √ = add offset of X to each lane

Explanation:

X Offset is taken from Right to Left

For example a two direction road (3 lanes each):

Offset **1** offset **2** offset **3** ---------- offset **3** offset **2** offset **1**

Appendix B: Configuring the laser trigger to MANUAL

This appendix describes the procedure of configuring the laser trigger to work in a manual mode. This mode is important for recovering in the event of a power loss.

To configure laser trigger to manual:

1. Click **Setup** tab in MDL configuration tool version **1.2.4.0**.
2. Click the **Upload button** and wait until you get **Done** message without any error message before.
3. Click **Trigger** tab.

NOTE: The Dead Zone parameters may change after upload.

4. Change the **Range Trigger** to **Manual**.
5. Change the **Range Trigger Window Values** to **Single Trigger**.

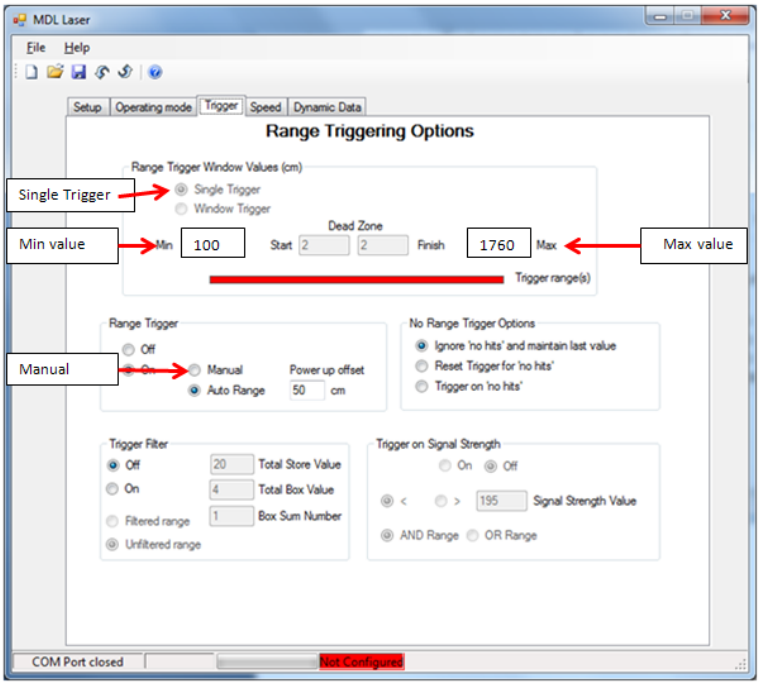


Figure 57: Range triggering options

6. Set the **Minimum** value to **100**.

7. Set the **Maximum** value to the value that was in Start of the **Dead Zone**.

8. Click **Download button** and wait until you get **Configured** message without any error message before.

9. **Power off**. On the laser, repeat the **upload step** and verify that the parameters you've just configured are saved in the laser.

10. Confirm that the laser is working, according to **stage 15** in **check list form**.

Appendix C: Ground Loop, Specifications & user guides

SMA Datasheet

SMA
Single loop detector
with **12** to **24V ac/dc** power supply

SMA2
Dual loop detector
with **12** to **24V ac/dc** power supply

SMA230
Single loop detector
with **230V ac** power supply

TECHNICAL SPECIFICATIONS

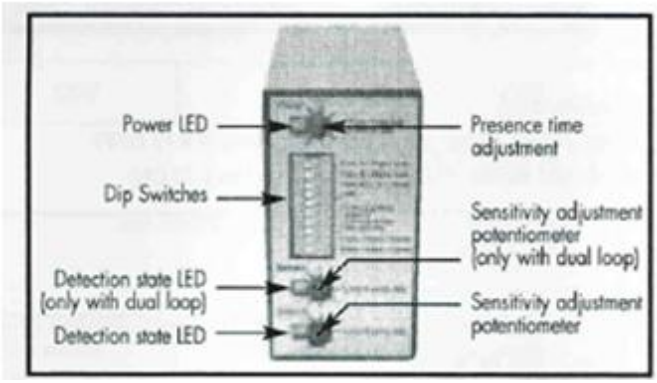
Technology	inductive loop
Tuning	automatic
Detection mode	presence
Presence time	1 min to infinity (permanent presence) with 250 steps
Pulse time output	100 ms or 500 ms
Inductance range	20 µH to 1000 µH
Frequency range	20 kHz to 130 kHz
Frequency steps	4 for single loop 2 for dual loop (for each loop)
Sensitivity (ΔL/L)	0.005% to 0.5% with 250 steps
Reaction time	25 ms for single loop 50 ms for dual loop (each channel)
Setup time at power on	8 s max by channel
Power supply (depending on model)	12-24 AC/DC ±10% 230 V AC ±10%
Mains Frequency	48 to 62 Hz
Power Consumption	< 2.5 W
Storage temperature range	-30°C to +70°C
Operating temperature range	-30°C to +40°C
Degree of protection	IP40

2 Output relays (free potential change-over contact)
- max contact voltage : 230 VAC
- max contact current : 5A (resistive)

LED indicators
- 1 green LED : power
- 1 red LED : Loop status 1
- 1 red LED : Loop status 2

Protections
- loop insulation transformer
- zener diodes
- gas discharge clamping

Connection	standard 11-pin round connector 86CP11
Dimensions	77mm (H) x 40mm (W) x 75mm (D)
Weight	< 200gr
Product compliance	R&TTE 1999/5/EC EMC 89/336/EEC UL listed equipment for UL 508



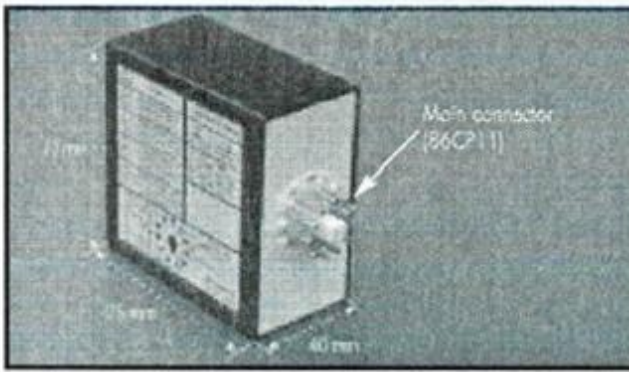


Figure 58: SMA Datasheet

Matrix Ground Loop User Guide

The following pages are datasheet pages of the Matrix Ground Loops User Guide. For additional details, refer to:

- http://www.beainc.com/beainc/Downloads/Products/Matrix/

BEA
We open up New Horizons
A HALMA GROUP COMPANY

USERS GUIDE
MATRIX
DIGITAL INDUCTIVE LOOP SENSORS

APPLICATIONS

The MATRIX Digital Inductive Loop Detector is the ideal solution for parking barrier control, motorized gates and doors, vehicle access control and industrial control systems.
The MATRIX is a high performance single or dual-channel vehicle detector packaged in a compact housing. The connection is made with a standard industrial 11-pin round connector.
The six versions listed below include single or dual-channel, and 3 possible power supplies:

10MATRIXS110	:	Single loop detector with 110 to 120 V AC power supply.
10MATRIXS220	:	Single loop detector with 220 to 240 V AC power supply.
10MATRIXS1224	:	Single loop detector with 12 to 24 V AC/DC power supply.
10MATRIXD110	:	Dual loop detector with 110 to 120 V AC power supply.
10MATRIXD220	:	Dual loop detector with 220 to 240 V AC power supply.
10MATRIXD1224	:	Dual loop detector with 12 to 24 V AC/DC power supply.

TECHNICAL SPECIFICATIONS

Technology : Inductive loop
Tuning : automatic
Detection mode : presence
Presence time : 1 min to infinity (permanent presence) with 250 steps.
Pulse time output : 100 ms or 500 ms
Inductance range : 20 µH to 1000 µH
Frequency range : 20 kHz to 130 kHz
Frequency steps : 4 for single loop
2 for dual loop (for each loop)
Sensitivity (ΔL/L) : 0.005% to 0.5% with 250 steps
Reaction time : 25ms for single loop
50ms for dual loop(each channel)
Setup time at power on : 8 s max by channel
Setup time after configuration : 2s max by channel
Power supply (depending on model) :
- 12-24 AC/DC ± 10%
- 230VAC ± 10 %
- 115VAC ± 10 %

Power Frequency : 48 to 62 Hz
Power Consumption : < 2.5 W

Temperature range : -22°F to 158°F
[-30°C to +70°C]

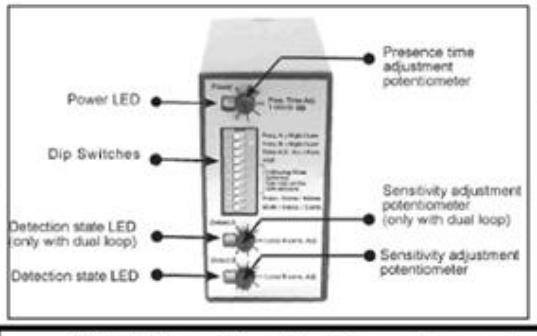
Degree of protection : IP40
2 Output relays (free potential change-over contact) :
- Max contact voltage : 230 VAC ;
- Max contact current : 5A (resistive).

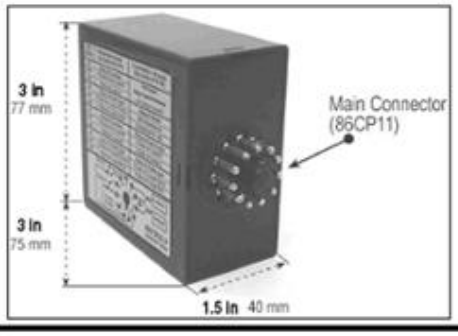
LED indicators :
- 1 green LED : power ;
- 1 red LED : Loop status 1 ;
- 1 red LED : Loop status 2.

Protections :
- loop insulation transformer ;
- Zener diodes ;
- gas discharge clamping.

Connection :
Standard 11-pin round connector 86CP11
Dimensions : 3 in (H) x 1.5 in (W) x 3 in (D)
[77mm (H) x 40mm(W) x 75mm(D)]
Weight : 7 ounces [< 200g]
Product compliance :
R&TTE 1999/5/EC
EMC 89/336/EEC
FCC 47CFR15
IC RSS-210 Issue 5

DESCRIPTION OF THE SENSOR


Presence time adjustment potentiometer
Power LED
Dip Switches
Sensitivity adjustment potentiometer (only with dual loop)
Detection state LED (only with dual loop)
Sensitivity adjustment potentiometer
Detection state LED



SAFETY PRECAUTIONS

- Shut off all power before attempting any wiring procedures.
- Maintain a clean & safe environment.
- Constantly be aware of traffic around the door or gate area.
- Always suspend traffic through the doorway or gate area when performing testing that may result in unexpected reactions by the door or gate.
- Always check placement of all wiring and components before powering up to insure that moving parts will not catch any wires and cause damage to equipment.

FCC COMPLIANCE

10MATRIXS110:	Matrix, Single Unit, 110 Volt AC supply	(FCC ID: G9B-MATRIX) (IC: 4680A-MATRIX)
10MATRIXS220:	Matrix, Single Unit, 220 Volt AC supply	
10MATRIXS1224:	Matrix, Single Unit, 12-24 Volt AC/DC supply	
10MATRIXD110:	Matrix, Double Unit, 110 Volt AC supply	
10MATRIXD220:	Matrix, Double Unit, 220 Volt AC supply	
10MATRIXD1224:	Matrix, Double Unit, 12-24 Volt AC/DC supply	

The Digital Transmitters and Receivers comply with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1) This device may not cause harmful interference and;
2) This device must accept any interference received including interference that may cause undesired operations.

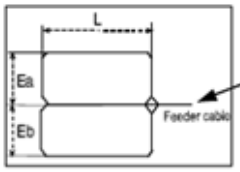
Changes or modifications not expressly approved by B.E.A., Inc. for compliance could void the user's authority to operate the equipment.

LOOP INSTALLATION TIPS

A . CABLE SPECIFICATIONS FOR LOOP AND FEEDER

- 16 AWG (1.5mm²) cross section area ;
- Multi-strand cable ;
- Insulation material : PVC or Silicone ;
- For the feeder cable, the wire must be twisted at least 15 times per yard for each cable.
- Feeder for long runs used for foil screened cable is recommended (earth at equipment end only)
- The feeder cable must be firmly fixed to avoid any false detection (max length: 330 feet (100 m)).
- Waterproof cable junction box is required.

B. LOOP GEOMETRY



- When two adjacent loops are connected to a dual channel sensor, it is possible for these loops to share a common slot, if so required. As the channels are multiplexed, no interference will occur.
- Avoid large loops or long feeder [max 330 feet (100 m)], or else the sensitivity will be affected.

C. DETERMINATION OF THE NUMBER OF LOOP TURNS

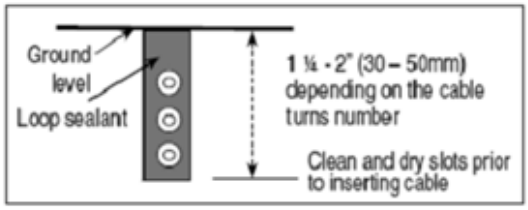
- Measure the length (L) and width (Ea) of one loop. Multiply these numbers together to determine the loop surface area. See above drawing.
- For example, if L=10 ft, Ea= 3 ft, then the area = 30 ft²; 4 loop turns are recommended.
  or if L=2m, Ea=1m, then the area = 2 m² ; 4 loop turns are recommended.

Recommended values for the turns:

Area		Number of turns
<32 ft²	<3 m²	4
32 – 54 ft²	3 – 5 m²	3
65 – 108 ft²	6 – 10 m²	2

WARNING:
For conformity reasons, in any installation, the loop surface multiplied by the number of turns should not exceed ***215*** (for square feet); ***20*** (for square meters)

D. SLOT DEPTH



WIRING

WARNING : Do not remove the grease on the connector's pins.

Pin 1 : Power Supply
Pin 2 : Power Supply
Pin 3 : Relay 2 (NO)
Pin 4 : Relay 2 (COM)
Pin 5 : Relay 1 (NO)
Pin 6 : Relay 1 (COM)
Pin 7 : Loop A
Pin 8 : Loop common and **connect to ground** ⏚
Pin 9 : Loop B
Pin 10 : Relay 1 (NC)
Pin 11 : Relay 2 (NC)

WARNING:
Pin #8 must be connected to the loop and to ground

PROGRAMMING

I. THE 3 CONFIGURATIONS

- Configuration A : single loop detector (MATRIX-S) ;
- Configuration B : dual loop detector in independent mode (MATRIX-D with dip switch #10 OFF) ;
- Configuration C : dual loop detector in combined mode (MATRIX-D with dip switch #10 ON).

Dip Switch	Configuration A Single loop		Configuration B Dual loop in independent mode		Configuration C Dual loop in combined mode	
	OFF	ON	OFF	ON	OFF	ON
DS#1	See next table		High (loop A)	Low (loop A) [High –30%]	High (loop A)	Low (loop A) [High –30%]
DS#2			High (loop B)	Low (loop B) [High –30%]	High (loop B)	Low (loop B) [High –30%]
DS#3	Active mode	Passive mode	Active mode	Passive mode	Active mode	Passive mode
DS#4	ASB OFF	ASB ON	ASB OFF	ASB ON	ASB OFF	ASB ON
DS#5	Relay A : Presence on loop A	Relay A : Pulse on loop	Relay A : Presence on loop A	Relay A : Pulse on loop A	Not used	Not used
DS#6	Relay A : Pulse on loop A entry	Relay A : Pulse on loop A exit	Relay A : Pulse on loop A entry	Relay A : Pulse on loop A Exit	Relay B : Non-Directional mode	Relay B: Directional A→B mode
DS#7	Relay B : Presence on loop A	Relay B : Pulse on loop A	Relay B : Presence on loop B	Relay B : Pulse on loop B	Relay B : Pulse on loop B	Relay B : Pulse on loop A
DS#8	Relay B : Pulse on loop A entry	Relay B : Pulse on loop A exit	Relay B : Pulse on loop B entry	Relay B : Pulse on loop B exit	Relay B : Pulse on loop entry	Relay B : Pulse on loop exit
DS#9	100 ms	500 ms	100 ms	500 ms	100 ms	500 ms
DS#10	Not used	Not used	Independent	Combined mode	Independent	Combined mode

II. POTENTIOMETERS

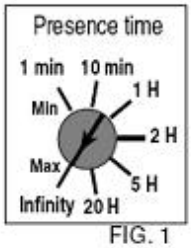


FIG. 1

- A potentiometer for adjustment of the maximum duration of a presence detection : from 1 min to infinity ; (see Fig. 1)
- A potentiometer for adjustment of the linear sensitivity (Δf) for the loop A : from 0.005% to 0.5 % ; (see Fig. 2)
- A potentiometer for adjustment of the linear sensitivity (Δf) for the loop B : from 0.005% to 0.5 %. (see Fig. 2)

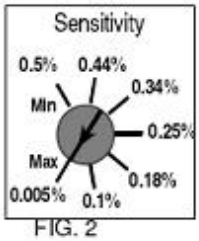


FIG. 2

DIPSWITCH SETTINGS

A 10 position dip switch is located on the front of the Matrix single detector. Dip switch 3, 5, 6, 7, and 8 configure the relay, while dip switch 9 controls the duration of the pulse when the Matrix is configured for pulse operation, (as opposed to presence). Configurations are as follows:

Dip Switch 3:

OFF= FAIL-SECURE MODE Relay is NOT energized when power is applied. Relay is energized upon detection only. In this mode, the N.O. circuit is open, and the N.C. circuit is closed. Thus, if a closed circuit is required upon detection, one must use the N.O. and COM terminals since they would close upon detection. When the Matrix is NOT powered, it is in the same state as it would be for non-detection.

ON = FAIL-SAFE MODE Relay is energized as soon as power is applied, and de-energizes upon detection or power loss. In this mode, upon powering the detector, the N.O. circuit becomes closed, and the N.C. circuit becomes open. Thus, if a closed circuit is required upon detection, one must use the N.C. and COM terminals, since they would now be OPEN during non-detection, and would close upon detection. When the Matrix is NOT powered, it is in the same state as it would be for detection.

Detection Status	Fail-Secure Mode (Active Mode) (Relay is not energized upon power-on) Dipswitch 3 OFF	Fail-Safe Mode (Passive Mode) (Relay becomes energized upon power-on) Dipswitch 3 ON
No Detection	The COM and N.O. terminals are OPEN. COM and N.C. terminals are CLOSED. The relay is de-energized.	The COM and N.O. terminals are CLOSED. COM and N.C. terminals are OPEN. The relay is energized.
Detection	The COM and N.O. terminals are CLOSED. COM and N.C. terminals are OPEN. The relay is energized.	The COM and N.O. terminals are OPEN. COM and N.C. terminals are CLOSED. The relay is de-energized.
Upon Power Loss	The COM and N.O. terminals are OPEN. COM and N.C. terminals are CLOSED The relay is de-energized.	The COM and N.O. terminals are OPEN. COM and N.C. terminals are CLOSED. The relay is de-energized.

Same

Same

DIPSWITCH SETTINGS

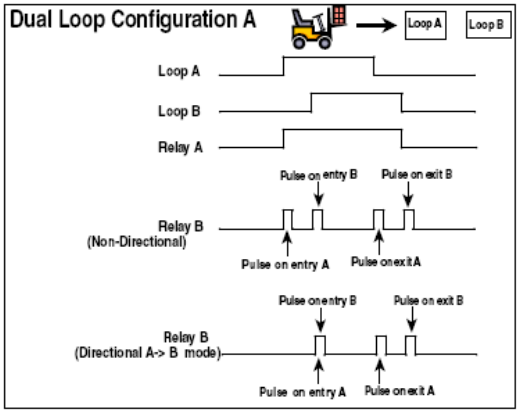
III. DIP SWITCHES

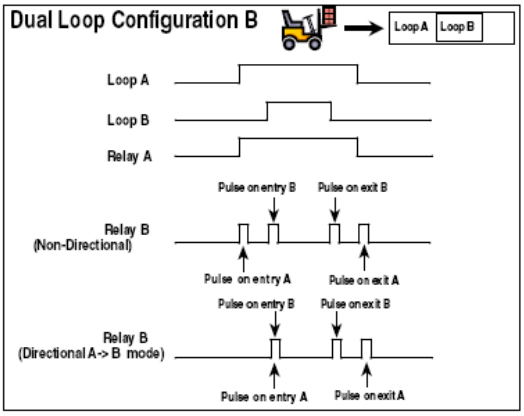
After each dip switch change the sensor launches a learning process.

Dip Switch #1	Frequency Adjustments of Loop A (see **ADJUSTMENTS** on the next page)
Dip Switch #2	Frequency Adjustments of Loop A (with single loop) or Loop B (with dual loops)
Dip Switch #3	Relay configuration : active (fail-secure) or passive (fail-safe_ (see above)
Dip Switch #4	**A**utomatic **S**ensitivity **B**oost (ASB option) [recommended for improved truck detection] : During a detection, the sensitivity increases automatically to 8 times the preset sensitivity given by the sensitivity potentiometer adjustment. It is limited to the maximum sensitivity (Δf = 0.005%). It goes back to the preset value after detection stops.
Dip Switch #5	Relay A function : presence or pulse (not used with dual loop in combined mode)
Dip Switch #6	Relay A Pulse type : entry or exit (used only at pulse function) or Relay B mode (with dual loop in combined mode) (see drawing on next page) • Non-Directional : Relay B provides a pulse according to the dip switches #7 and #8 setting. • Directional A→B : Relay B provides a pulse only if loop A is detecting before loop B. The logic detection takes place according to dip switches #7 and #8. **Warning** : During the detection, the 2 loops have to detect simultaneously for a short period to be able to determine the movement direction. During loop installation make sure the 2 loops are close enough to each other to ensure a common detection (typical 3 feet).
Dip Switch #7	Relay B function : presence or pulse Or loop selection for relay B pulse : pulse on Loop B or pulse on Loop A (used with dual loop in combined mode)
Dip Switch #8	Relay B Pulse type : entry or exit (used only at pulse function)
Dip Switch #9	Pulse duration for both relays (used only at pulse function): 100 ms or 500 ms
Dip Switch #10	Dual loop mode : independent or combined A→B (not used with single loop)

ADJUSTMENTS

Frequency adjustment for loop A for single loop detector		
Dip Switch #1	**Dip Switch #2**	**Loop frequency**
OFF	OFF	High
ON	OFF	Mid High [High –20%]
OFF	ON	Mid Low [High – 25%]
ON	ON	Low [High – 30%]





LED SIGNAL

Green LED shows when the module is powered;
Red LED gives:

- the corresponding loop detection state in normal situation;
- the value of the oscillation frequency measurement or an error message on power ON.

Normally, the red LED stays ON as long as the loop is in a state of detection.

On **POWER ON,** the sensor measures the oscillation frequency of each loop. The result of this measurement is displayed using the corresponding red LED. The number of flashes indicates the tens value of the frequency. For example 4 short flashes correspond to a frequency between 40 kHz and 49 kHz. After this message the LED goes back to normal display.
If the loop oscillation frequency falls outside the limits (20 kHz to 130 kHz) the red LED displays an error message and the sensor activates the corresponding relay. The blinking frequency shows the type of error according to the next table. The sensor will stay in error mode until the error is cleared and the frequency goes to the right range.
Remark : The sensor launches automatically a learning process if the oscillation frequency varies more than 10% in comparison with the measurement value.

Loop frequency error	LED display
Oscillation frequency too LOW or loop opened	LED blinking at 1Hz
Oscillation frequency too HIGH	LED blinking faster at 2 Hz
Loop shorted or no oscillation	LED blinking slower at 0.5 Hz

TROUBLE-SHOOTING

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
The loop detector will not work. The green LED is off.	There is no power supply to the loop detector.	Check power supply.
The loop detector will not work. The red LED is flashing slowly (0.5 Hz).	The corresponding loop is shorted.	Check the loop cable.
The loop detector will not work. The red LED blinks at either 1Hz or 2Hz.	The frequency of oscillation falls outside the allowed range.	Adjust frequency with dip switches or change loop turns.
The loop LED is detecting properly but the contact is not made.	Bad connection of the relay contacts.	Check relay connections.
Dip switches 5 to 8 are not responding properly.	Their function varies according to dip switch #10 setting.	Check the appropriate loop mode required and adjust dip switch #10.

COMPANY CONTACT

If after troubleshooting a problem, a satisfactory solution cannot be achieved, please call B.E.A., Inc. for further assistance during **Eastern Standard Time at 1-800-523-2462 from 8am - 5pm.**
For after-hours, call East Coast: 1-866-836-1863 / Mid-West: 1-888-308-8843
West Coast: 1-888-419-2564. **DO NOT leave any problem unresolved.** If you must wait for the following workday to call B.E.A., leave the door inoperable until satisfactory repairs can be made.
NEVER sacrifice the safe operation of the automatic door or gate for an incomplete solution.
Web: www.beasensors.com